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aggregate resources

A STUDY REPORT

Sacramento County, California

AGGREGATE RESOURCES

A Study Report

by

Sacramento County,

The Aggregate Resource Management
Technical Advisory Committee

Conservation Mineral resources
Sacramento

Industries Mineral

November 1974

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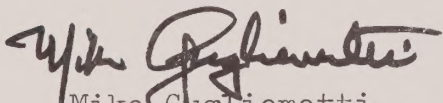
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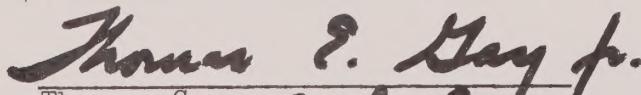
This report represents the efforts of ARMTAC in fulfilling the tasks given to us by your honorable board on December 5, 1973.

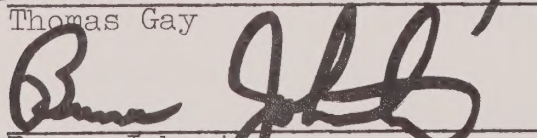
It is with great satisfaction that we submit this report to the Sacramento County Board of Supervisors. We are confident that the contents and recommendations of this study will assist the County of Sacramento in resolving the ever increasing problem of how to best manage the County's valuable aggregates resources, protect the community's social and economic interests, and safeguard the physical environment.

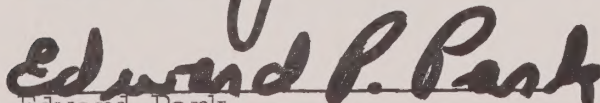
The committee wishes to thank the Board of Supervisors for having given us the opportunity to serve the County of Sacramento.

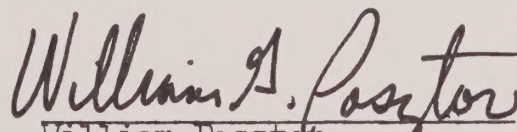
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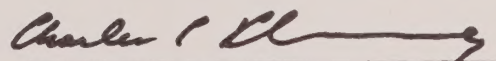

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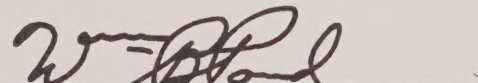

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TABLE OF CONTENTS

INTRODUCTION	1
SUMMARY	3
FINDINGS	10
POLICY RECOMMENDATIONS	11
GENERAL RECOMMENDATIONS	12

CHAPTER I PLANNING CONCERNS

THE LOCAL RESIDENT	13
THE AGGREGATE PRODUCER	15
1. <u>Increasing Demand</u>	16
2. <u>Finite Supply</u>	17
3. <u>Increasing Transportation Distance</u>	19
4. <u>Incompatible Land Use</u>	20
LOCAL GOVERNMENT AND THE AGGREGATE CONSUMER	22
IN REVIEW	26

CHAPTER II COMMERCIAL AGGREGATES

DEFINITION OF AGGREGATES	28
IMPORTANCE OF AGGREGATES	30
AGGREGATE STANDARDS	35
AGGREGATE PROCESSING	39

CHAPTER III LOCATION-SUPPLY-DEMAND-CHOICE

LOCATION-SUPPLY-DEMAND-CHOICE	47
POSSIBLE ANSWERS	49

CHAPTER IV AGGREGATE RESOURCES

GEOLOGIC OCCURRENCE	51
LOCATION OF AGGREGATE RESOURCES	57
PRECLUSIVE LAND USES	59

Chapter IV (cont'd)

ESTIMATE OF IDENTIFIED AGGREGATE RESOURCE SUPPLY	61
ESTIMATE OF FUTURE AGGREGATE RESOURCE NEEDS THROUGH THE YEAR 2000	62
IMPORTANCE OF OUT-OF-COUNTY AGGREGATE SOURCES	64
CONCLUSIONS	65

CHAPTER V MINING REGULATIONS

PRESENT REGULATIONS AND PROCEDURAL PROBLEMS	66
ARMTAC PROPOSED REGULATIONS AND PROCEDURES	68
<u>Applications for Aggregate Mining Use Permits</u>	68
<u>Mining Plan</u>	69
<u>Reclamation Plan</u>	69
<u>Property Line Mining Setbacks</u>	72
<u>Special Mining Setbacks</u>	73
<u>Slopes</u>	73
<u>Operating Time</u>	73
<u>Fencing and Posting</u>	74
<u>Traffic</u>	75
<u>Dust</u>	75
<u>Noise</u>	75
<u>Aesthetics</u>	76
<u>Wastes</u>	77
<u>Seeding</u>	77
<u>Water Quality</u>	77
<u>Run-Off and Flood Control</u>	78
RECOMMENDED COUNTY REGULATIONS	80
COMMENT	85

CHAPTER VI LAND USE RESOURCE MANAGEMENT

INTRODUCTION	86
ARMTAC RECOMMENDATION	86
ALTERNATIVE I	88
<u>Effectiveness</u>	90

Chapter VI (Cont'd)

ALTERNATIVE II	91
<u>Effectiveness</u>	92
ALTERNATIVE III	93
<u>Effectiveness</u>	95
ALTERNATIVE IV	96
<u>Effectiveness</u>	98

APPENDIX A

AGGREGATE STANDARDS	100
---------------------	-----

APPENDIX B

BIBLIOGRAPHY	101
--------------	-----

INTRODUCTION

The Sacramento County Environmental Conservation and Resource Management Element of the 1973 General Plan, adopted in June 1972 by the Sacramento County Board of Supervisors, contains a specific goal for mineral resources:

To protect the mineral resources from incompatible land use and to manage the mineral resources of Sacramento County to assure the community of an adequate supply of these resources with due consideration for the environment.

The Conservation Element, the mineral goal and seven explicit mineral policies set forth a new level of consciousness in the County's planning and environmental protection efforts. However, in the ensuing months after the Conservation Element's adoption it became apparent that there was not enough resource deposit data upon which land use and use permit decisions could be made. Consequently, the Board of Supervisors created the Aggregate Resource Management Technical Advisory Committee (ARMTAC) in December of 1973 to develop a thorough planning approach for aggregate resource management, land reclamation, and environmental nuisance and hazard prevention.

Five tasks were assigned to ARMTAC by the Board of Supervisors:

1. Assist in identifying sand and gravel resources in Sacramento County.

2. Assess the need for sand and gravel through the year 2000.
3. Assist in the preparation of regulations and policies for sand and gravel operations which will result in a minimum of environmental and operational conflicts.
4. Assist in the development of plans for the reclamation and re-use of mined lands.
5. Advise the Board of Supervisors and the Planning Commission in the updating of the Conservation Element of the County General Plan.

This report addresses the five specific tasks in the context of the policies in the General Plan Conservation Element on minerals and mining.

SUMMARY OF THE REPORT

Aggregates are an important, fundamental building material. In loose form without a cementing binder, aggregates are used as foundation base material for all types of roads, walks, houses, parking lots, railroad beds and airport runways. Sand and gravel used with a binder such as portland cement or asphaltic cement comprise about three-fourths of the volume of most concretes and road pavements. In these forms, aggregates support or comprise floors, foundations, walks, walls, garages, streets, bridges, dams, overpasses, patios, etc. As a consequence, aggregates are no less important than wood, steel or any other essential material used in building and construction.

As an example of how much society depends on aggregates, a typical single family slab constructed home with its required street improvements consumes approximately 100 tons of sand and gravel.

The extensive use of aggregates in our urban environment virtually makes each one of us a consumer. With few exceptions, the market demand for sand and gravel products increases as development and population densities increase. This relationship has been true, for the most part, in Sacramento County.

From 1880 to 1951, some 22 million tons of sand and gravel were produced in Sacramento County. Over 47 million

tons were produced from 1952 to 1961, and an additional 55 million tons from 1962 to 1971. This increase in gross production bears a direct relationship with the growth in the County's population over the past thirty years.

The Sacramento metropolitan area presently consumes over eleven times the amount of aggregates today that it did in 1941. In recent years, aggregate operations in Sacramento County have provided over six million tons of sand and gravel materials annually.

Prognostications were performed to determine the future aggregate production levels that would be necessary to serve the Sacramento metropolitan area. These estimates were based upon several key assumptions:

- a) Past production figures are relatively accurate;
- b) Production closely reflects the Sacramento County demand for aggregate materials;
- c) The importance and use of aggregate as a construction material will not change substantially in the foreseeable future; and,
- d) The population projections made for Sacramento County by the Planning Department are reasonable.

Based on the above assumptions and past consumption rates, it is estimated that Sacramento County will need between ¹⁷⁰~~191~~ and 212 million tons of aggregates to satisfy its construction and maintenance needs through the year 2000.

The sources of aggregate for Sacramento County were researched to the greatest detail possible using existing

information. Other than the County's naturally occurring deposits of high quality sand and gravel, other sources of aggregate were examined. The utilization of dredger tailing deposits was found to be extremely limited due to current user specifications which require durable, strong and well sorted particles; these are qualities absent from about two-thirds of the 12,000 acres of dredger tailings in the County.

Importation from out-of-county sources was found to be an expensive method to satisfy the local demand for aggregate construction materials since such distant sources result in significantly higher material prices due to high transportation costs.

Fortunately, Sacramento County has been blessed by abundant deposits of high quality sand and gravel. For outlying areas along and south of the Cosumnes River, little is known as to the existence and extent of aggregate deposits. However, these remote areas are presently of little relative importance to the consumer and producer due to their great distance from the aggregate market center, and the presence of more convenient supplies nearer the urban area.

Much more is known about sand and gravel deposits along, and south of the American River to beyond the urban fringe of Rancho Cordova, Rosemont and College Greens. Although urban growth has precluded the extraction of many aggregate

deposits which lie on both sides of the American River Parkway, it is believed that there are still approximately 238 million tons of high quality sand and gravel that if well managed, could be harvested in the future. These deposits are generally located southwest and northeast of Mather Air Force Base, largely within its noise zones.

The great importance of aggregates as a basic building and maintenance material for both public and private projects makes the management of sand and gravel resources a basic responsibility for Sacramento County. Since aggregates are an integral part of urban America, and are expected to remain so, the identification and preservation of this valuable resource is imperative for economic and social reasons.

Unless effective measures are applied to manage local sand and gravel resources to provide for local needs beyond the year 2000, Sacramento County may face definite shortages, and may have to rely upon the expensive alternative of importation of sand and gravel from distant sources. This could more than double the cost of delivered aggregate to the consumer and materially reduce tax revenues to the County.

While positive land use measures are needed in order to effect a secure economical supply of aggregates for the future, resource management does not end there. There is an equally important responsibility for the County of Sacramento to effectively protect present and future residents from

nuisances, hazards, and environmental injury. Past experiences in Sacramento County, as elsewhere, clearly indicate:

- a) A history of significant incompatibility between residential and surface mining land uses;
- b) A need for detailed requirements for reclamation of mined lands;
- c) A need for specific operation requirements and inspections.

The County of Sacramento can draw tighter its regulatory reins to protect the community by preventing nuisances such as objectionable noise levels, excessive dust, and congested traffic, and by preventing hazardous conditions such as unstable slopes or pits, and by ensuring a minimum acceptable form and degree of reclamation in the shortest possible time.

In this study report, policy findings on resource management and surface mining control are made with specific recommendations for land use and resource preservation measures, and mining regulation spanning the subjects of use permit procedures, reclamation, setbacks, noise, dust, aesthetics, wastes, water quality, performance bonding and periodic inspections.

In regard to land use and resource management, a broad range of measures were studied in detail and four basic alternatives were formulated. Of these studied alternatives, ARMTAC unanimously selected number three as the most desirable

environmental management proposal designed to adequately protect the identified resources as well as the environment.

The recommended alternative....:

1. Establishes clear land use policies for surface mining, resource conservation, and environmental protection;
2. Creates the land use management tools necessary to establish a distinct relationship between resources, land uses, and zoning regulations;
3. Establishes a new General Plan land use category, a new combining zoning district for surface mining, and a use permit process which would effectively manage sand and gravel operations and resources while providing the means for protecting the community and the physical environment from nuisance and harm;
4. Provides a uniform methodology to process use permit applications;
5. Discourages the development of single family houses on lots less than ten acres in size within the aggregate resource area;
6. Identifies aggregate resource areas in the General Plan map and in the Environmental Conservation and Resource Management Element map. This same technique could be used to identify other mineral resources; and,
7. Identifies in the zoning maps where surface mining could occur.

The adoption of this report and the implementation of its recommendations would be a landmark act, in the scene

of local government, towards a constructive and effective surface mining program in planning, resource management and public protection.

FINDINGS

1. AGGREGATES ARE A VERY VALUABLE DIMINISHING NATURAL RESOURCE TREMENDOUSLY IMPORTANT TO THE PHYSICAL AND ECONOMIC DEVELOPMENT AND WELL-BEING OF SACRAMENTO COUNTY, DESERVING CAREFUL LAND USE MANAGEMENT TO ENSURE ITS JUDICIOUS HARVESTING AND USE.
2. THE SURFACE MINING, PROCESSING, SALE AND USE OF AGGREGATE PRODUCTS IS AN IMPORTANT INDUSTRY WHICH PRODUCES MANY SIGNIFICANT LAND USE IMPACTS.

POLICY RECOMMENDATIONS

The research and findings of this aggregates study leads the Aggregate Resource Management Technical Advisory Committee to recommend that the following policies be adopted by the County of Sacramento with the simultaneous amendment of the existing relevant policies in the Conservation Element of the General Plan.

1. LAND USES WHICH PRECLUDE AGGREGATE RECOVERY AND PROCESSING SHOULD BE AVOIDED IN AGGREGATE RESOURCE AREAS. THE RESOURCE AREA SHOULD BE ESPECIALLY BUFFERED FROM RESIDENTIAL USES, AND OTHER USES INCOMPATIBLE WITH SURFACE MINING, WITHIN OR ADJACENT TO IT.
2. THE APPLICANT FOR A MINING PERMIT SHOULD BE REQUIRED TO DEMONSTRATE THAT AFTER MITIGATIVE MEASURES ARE TAKEN, THE PROPOSED OPERATION WILL NOT CREATE ANY SIGNIFICANT NUISANCES, HAZARDS, OR ADVERSE ENVIRONMENTAL IMPACTS.
3. AGGREGATE MINING PERMITS SHOULD BE COVERED BY WELL-DEFINED ADMINISTRATIVE PROCEDURES FOR HANDLING ALL ASPECTS OF THE PERMIT, INCLUDING OPERATION AND RECLAMATION PROGRAMS.
4. RECLAMATION OF MINED LANDS SHOULD BE A REQUIREMENT ISSUED WITH SURFACE MINING PERMITS TO PROTECT THE SCENIC AND ECONOMIC VALUE OF THE COUNTY.
5. ENCOURAGE, SUPPORT AND CONDUCT RESEARCH AND DATA GATHERING EFFORTS AIMED AT LOCATING AND IDENTIFYING MINERAL RESOURCES WITHIN SACRAMENTO COUNTY, AND USE THIS INFORMATION IN A LONG-RANGE AND CONTINUOUS MINERAL RESOURCE CONSERVATION EFFORT INTEGRATED INTO THE COUNTY'S COMPREHENSIVE PLANNING PROGRAM.
6. AGGREGATE MINING AND RESOURCE CONSERVATION SHOULD BE ENCOURAGED TO PROVIDE LOW CONSUMER COSTS BY PROMOTING THE UTILIZATION OF SAND AND GRAVEL RESOURCES CONVENIENT TO THE URBAN AREA, AND BY ALLOWING COMPETITION AMONG THE DIFFERENT AGGREGATE PRODUCERS.

GENERAL RECOMMENDATIONS

The Aggregate Resource Management Technical Advisory Committee hereby recommends to the Board of Supervisors that the County of Sacramento:

1. Accept this report on Sacramento County aggregate resources as a fulfillment of the five tasks that were assigned to ARMTAC by the Board of Supervisors.
2. Adopt Chapter V of this report on surface mining regulation as an emergency interim measure until final judgment is passed on the implementation of the overall report.
3. Forward the entire report to the Planning Commission to incorporate the appropriate portions of the report into the environmental conservation and resource management element of the County General Plan, and to study the best means to implement the report's recommendations.
4. Direct the appropriate county agencies and departments to participate in the implementation of this report by developing the necessary administrative procedures, and by drafting the necessary ordinances to effectuate the policies and recommendations of this report.
5. Instruct the appropriate county officials to investigate all surface mining sites in operation without a valid use permit. Inform the Planning Commission and the Board of Supervisors on their findings and action.
6. Move toward the implementation of land use and resource management alternative number three as proposed in this report.

In the process of granting the permit applications for the mining and processing of aggregates, three main forces are in play, each with identifiable interests: the local resident, the aggregate producer, and the aggregate consuming public, all represented by local government. Each of these forces were exercised at the onset by IMBIO to identify the concerns the study should bear in mind.

THE LOCAL RESIDENT

CHAPTER I

PLANNING CONCERNS

Past experiences in Sacramento County, as elsewhere, clearly demonstrate that local residents generally view sand and gravel operations as extremely undesirable neighbors even if they take several miles away from a proposed site. Objections and resistance by residents to the use of nearby land for aggregate surface mining and processing are usually founded on personal concerns that they may suffer from some form of physical nuisance, harm and/or economic injury. Also there are more general concerns as to whether aggregate mining will create unsightly land forms or cause adverse environmental impacts.

The time when the most citizen objections emerge over aggregate operations is at the public hearings for conditional use permits. There are many reasons for this phenomenon. Due to past experiences, people tend to lack confidence in local government's ability to adequately protect

In the process of granting use permit applications for the mining and processing of aggregates, three basic forces are in play, each with identifiable interests: the local resident, the aggregate producer, and the aggregate consuming public, all represented by local government. Each of these forces were examined at the onset by ARMTAC to identify the concerns the study should bear in mind.

THE LOCAL RESIDENT

Past experiences in Sacramento County, as elsewhere, clearly demonstrate that local residents generally view sand and gravel operations as extremely undesirable neighbors even if they live several miles away from a proposed site. Objections and resistance by residents to the use of nearby land for aggregate surface mining and processing are usually founded on personal concerns that they may suffer from some form of physical nuisance, harm and/or economic injury. Also there are more general concerns as to whether aggregate mining will create unaesthetic land forms or cause adverse environmental impacts.

The time when the most citizen objections emerge over aggregate operations is at the public hearings for conditional use permits. There are many reasons for this phenomenon. Due to past experiences, people seem to lack confidence in local government's ability to adequately protect

them and the environment from harm. Use permits issued in the past have provided a superficial form of regulation through vague conditions which are almost impossible to enforce. Community controversies over aggregate operations along the American River have contributed to further establish people's fears.

There are many factors associated with aggregate mining having potential adverse environmental impact. Those most frequently identified by citizens are noise, dust, safety hazards, aesthetics and heavy traffic.

Resident concerns about noise depend upon its overall volume, its nature, the source, and the time of day at which the noise occurs. Potential noise, whether from movable sources (e.g., haul trucks) or from stationary sources (e.g., processing plants) appears as a threat to many residents who are near a proposed aggregate site or along a possible traffic route for haul trucks.

Existing and future sand and gravel haul routes generate concerns about truck noise, traffic hazards to children, nuisances of dusty, pebble-littered roads and yards, and increased traffic congestion.

Residents also envision that dust created by aggregate production and hauling may impair the economic value and enjoyment of their property just as noise pollution can. Plants, patios and exterior finishes covered by dust, and

dust-soiled windows, swimming pools and heating/cooling intake filters are often among the images in a resident's mind when considering a potential aggregate operation in the community.

Aesthetics are another concern. Some people view open pit mining and aggregate processing sites to be community eyesores, during and after mining has occurred. Barren dredger tailing deposits and vacant barrow pits created in the early years give substance to people's fears of land despoilation. Land reclamation, a low priority for public concern in the past, is now of utmost interest to many people in the community. Of course, community image is not the only reason why people are concerned for aesthetics. The protection of property values is perhaps a more fundamental reason for local resident concern.

THE AGGREGATE PRODUCER

Today's sand and gravel producer is confronted by increasing demands for aggregate products; rising costs for land, machinery, and labor; competing land uses; a need for a reasonable economic return on investment; and increasing opposition by some people against the character, the results, and thus any expansion of aggregate operations. Many factors compound and interlock these concerns of the aggregate industry. Those factors that have land use planning and policy

implications include:

1. A steadily increasing consumer demand for aggregate products;
2. A finite supply of high quality aggregate resource;
3. An increasing transportation distance between supply and site of use; and,
4. An incompatibility between urban land uses, especially residential, and aggregate mining and processing.

1. Increasing Demand

As will be explained later, sand and gravel products are fundamental construction materials. For vertical construction, such as high rise office and apartment buildings, the availability of alternative building materials is limited. For horizontal construction, such as streets and walks, there are no economically feasible substitutes for aggregate building materials. The use of aggregate materials is extensive now; and the forecast of a higher, future market demand is supported by the experience and statistical evidence of those intimately familiar with this type of business (e.g., the State Division of Mines and Geology).

While the per capita production of aggregate products in Sacramento County has been relatively constant for the past twenty years, the population has been increasing. The total result, of course, has been an increasing demand for

aggregate materials. The means of meeting this demand are limited to the expansion of existing operations and the addition of new ones.

The ability to exercise either option to meet the County's anticipated demand for sand and gravel depends first upon the industry's ability to obtain conditional use permits from the County government. Increased demand per se is not a problem. Locating adequate resources and then obtaining use permits in order to increase or extend aggregate production to meet that increased demand are the real obstacles which often confront sand and gravel producers.

2. Finite Supply

The aggregate operator cannot locate a production facility wherever he might like to. Sand and gravel, like other natural resources, can be extracted only from areas where nature has placed the deposits. Since aggregates are not uniformly deposited throughout the land, the supply of commercial aggregates is controlled by availability of the resource - its location, quantity and quality.

Presuming quantity and quality of raw sand and gravel are within acceptable limits, location of aggregate supplies can be a key factor from an economic viewpoint, in that more distant supplies necessitate higher transportation costs. In the case of a resource deposit located close to a market

within the urban environment, more stringent regulations, higher property costs, smaller parcels and more frequent land use conflicts, all contribute to increased operating overhead. As with any business concern, an aggregate producer will pass on all overhead costs possible to the consumer. The aggregate operator has a concern for selecting the location which permits the most competitive market price of delivered products - that is, a location which is economically convenient to the consumer market yet minimizes both the high cost of the urban related overhead problems, and the cost of transportation.

In addition to favorable location, an aggregate resource deposit must also be of good quality to be considered as an acceptable commercial supply of sand and gravel. Quality of the raw material is important since most sand and gravel products must fulfill strict market specifications set by government agencies such as Cal-Trans and the U.S. Bureau of Reclamation. Occasionally, a low grade deposit can be improved through additional processing, (requiring additional cost) or can be selectively marketed, with limited commercial leverage, but these are undesirable alternatives because the added cost or limited marketability places the operator in a less competitive or untenable business position.

Even when quality and location aspects of a sand and gravel deposit are excellent, to be commercially feasible the deposit must offer enough material to retire all investment obligations and operating expenses, and to result in a profitable operation. Major new aggregate plants that are large enough to be competitively efficient normally require a multi-million dollar investment with an amortization period of twenty years or more. Thus, another criterion of a commercially suitable deposit is that it must yield good quality aggregate material for at least twenty years, or that amount of time necessary to retire costs and provide profit.

3. Increasing Transportation Distance

Transportation is an extremely significant planning consideration. As briefly mentioned above, a sand and gravel producer must evaluate the cost aspect of transportation, and the potential nuisance the hauling traffic can create for urban dwellers, e.g., noise, dust, vibration.

Because aggregates are a bulky, low-cost material, an appropriate mineral deposit is selected only after considering the economics of transportation cost between source and consumer. The necessity of such an evaluation is assignable to the direct increase in the delivered cost of sand and gravel due to added transportation costs, which increase as

the source becomes more distant from the consumer. In order to achieve a more competitive price for their products, aggregate operators must minimize transportation distances (and therefore expense) between mining site and processing plant, and between processing plant and consumer. When adverse urban conditions force the sources of aggregate products farther away from the market center, increased consumer costs are inevitable.

It is generally agreed that from the standpoint of competitive economics, an aggregate site is rarely feasible when it requires an extra twenty miles or more of haul distance to serve the same market. That is why aggregate producers in nearby Yolo, Placer, and San Joaquin Counties have been unsuccessful in competing in the Sacramento sand and gravel market.

4. Incompatible Land Use

Due to the substantial economic importance of the transportation distance/cost relationship of aggregates with market competitiveness, commercial operations tend to be located as close as possible to the market center, risking the potential problem of encountering adverse, intensive, urban forms of land use, higher land values, higher property taxes and more stringent land use regulations, that are all concomitant with the urban environment.

The degree of business risk for the operator is indeed substantial when one considers the numerous situations where aggregate operations have been either restricted or fully enjoined from operating by local governments and the courts. In many ways, the magnitude of this risk can be contributed to the aggravation and alienation of urban dwellers by past and some present aggregate operations. In an unfortunate sense, the sand and gravel industry is in part a victim of circumstances because past social attitudes did not demand high performance standards for mining operations. Due to the contemporary awareness in environmental issues, the community now often characterizes mining operations by what they have been in the past, rather than recognizing the improvements currently being made, or what could be done in the future.

An aggregate producer is confronted with a plethora of land use questions for which there are few firm answers. Land is purchased or leased for mining purposes only after cautiously weighing these questions: 1) Can a use permit be obtained and maintained? 2) Can all zoning, grading, reclamation, and other types of regulations be met? 3) Will residential land use in the future encroach upon the mining site and thereby endanger its operation?

All of these factors make the siting of an aggregate operation a difficult process at best. Under the worst conditions, the aggregate industry has found it impossible to

operate within certain areas in California, notably in the San Francisco Bay Area and Southern California. Even though the industry has been unable to operate in some areas, the need for aggregate materials to maintain and to continue development has not diminished. Therefore, it has been necessary for aggregate materials to be transported from great distances away, making the cost to the consumer quite high.

There is no doubt that the need for aggregate materials will continue in the future; and so too, the aggregate industry will continue to exist. The question is, "Will the aggregate industry continue to exist in Sacramento County?" The answer to this question will depend substantially on Sacramento County's land use planning policies and regulations.

LOCAL GOVERNMENT AND THE AGGREGATE CONSUMER

The local aggregate consuming public, represented by the Sacramento County Board of Supervisors, is the third interest party in aggregate resource planning and utilization. Entrusted with the responsibility of protecting the health, safety and welfare of the entire community, the Board of Supervisors has found several issues it must resolve as a unit of local government:

- a) How to provide for adequate and economical supplies of commercial sand and gravel to fulfill future

construction needs in maintaining and developing Sacramento County.

- b. How to protect the interests of all those local citizens potentially affected by possible nuisances and hazards created by sand and gravel operations.
- c. How to regulate fairly the interest of all those property owners where aggregate deposits are located.

The County has several reasons for instituting some form of sand and gravel resource management to provide for the future. All of these reasons have a common theme of minimizing the net total community cost in an environmental as well as an economic sense. Maintenance, improvements, and new construction utilize aggregate construction materials in a variety of forms. The improper management of the County's aggregate resources could result in substantial higher aggregate construction costs, due either to increased transportation costs, or to the use of more expensive alternative building materials and designs.

It is recognized that the proper husbandry of sand and gravel resources first concerns those deposits closest to urbanization, as a greater incompatibility of uses exists between mining and urban land uses than between mining and rural-agricultural land uses. Also, the deposits nearest the urban market center should be utilized first because they can provide aggregates at lower cost due to shorter

transportation distances.

The availability of economical supplies of sand and gravel materials benefits the whole community. Lower construction costs achieved through utilization of lower cost aggregate materials provide savings to both the individual consumer (e.g., the new home buyer) and the taxpayer (e.g., the user of highways). The cost of private development, whether commercial, residential, or industrial, has an inflexible cost relationship to aggregate prices; thus, the owner of every private construction project benefits directly through savings made possible by the availability of economical sand and gravel supplies.

Practically all of the capital improvement construction of the City, County, and the many special districts utilize aggregate materials. Flood channels, canals, bridges, roads, runways, parking lots, buildings, and maintenance of existing structures are all performed with taxpayer monies, and all consume significant tonnages of aggregate materials. If an economical market supply of aggregates can be utilized, capital projects will cost less to the taxpayer. This is another reason why the preservation and management of aggregate resources is an important issue for the public's purse.

In providing for aggregate resource management in the interest of the whole community, there is still a responsibility to people who are subject to the physical influence

of mining and processing activities. Protecting residents and property owners from nuisance and hazard is no less important than resource management when aggregate activities aggravate or create conditions adverse, detrimental, and iniquitous to nearby land uses. In seeking to provide economical future supplies of aggregates, the Board should be equally interested in preventing conditions and situations that thrust adverse environmental and economic impacts upon existing and future land uses in the vicinity of resource deposits. Thus, any aggregate resource mining policy and planning measure that is adopted by the County should address itself to how mining can be regulated to minimize adverse environmental, social and economic impact.

The presence of over 12,000 acres of dredger tailing deposits serves as a reminder to Sacramento County residents of what can happen without the benefit of sound reclamation regulations of surface mining. These relatively barren tailing areas and the past disputes concerning mining operations along the American River have highlighted a pressing County need for specific conditions for reclamation, nuisance, hazard and environmental control armed with an effective enforcement program.

The last, but not least, issue of consideration is that of the interests of property owners where resource deposits are located. Measures necessary to serve the other two

groups of individuals inevitably will restrict to some extent the land use alternatives of some property owners. Those most affected may well be the property owners of aggregate resource deposits in Sacramento County. It is, therefore, important that the County's regulatory powers are judiciously wielded, incorporating the interests of these regulated property owners, carefully balancing the interests of all parties involved and affected.

IN REVIEW

The careful and deliberate management of the earth's natural resources is a difficult concept for most local governments. Here in Sacramento County however, it has become very clear that the management of aggregate resources is both a worthy effort in the public interest, and an achievable objective.

It is further recognized that the provision of remedy and protection for those who may be aggrieved and adversely affected by open pit mining and aggregate processing, for those who own potential aggregate resource bearing lands, and for those who desire to mine, is a difficult task facing local governments throughout California. Resource management and public protection are important planning and regulatory functions of government that require the understanding of a broad spectrum of interests and concerns. This under-

standing is essential to ensure that the tools necessary to attain a worthwhile measure of success in mining regulation and mined lands reclamation are effectively developed and utilized to protect citizens, manage natural resources, and regulate aggregate mining and processing land uses.

The Aggregate Resource Committee has found it necessary to study intensively all of the basic aspects of the subject before it could sensibly recommend the necessary planning and regulatory tools. These fundamentals are reviewed to provide a basis for understanding what aggregates are, why they are important, and what we presently know about their location and abundance in the County.

DEFINITION OF AGGREGATES

Aggregate is a bulky, strong, relatively inexpensive, granular material that is used either as an unbound base material, or as a filler firmly bound with cementing materials to provide hardened, durable and relatively permanent structural substances such as concrete.

In commercial usage, "sand" applies to rock or mineral fragments ranging in size from three-thousandths of an inch to a quarter of an inch. "Gravel" consists of rock or mineral fragments larger than a quarter of an inch ranging up to three and one-half inch maximum size. Approximately nine-tenths of the state's output of sand and gravel is used as aggregate in mixtures with a binder of either portland cement or asphalt compounds, for use in construction and road building. The remaining one-tenth is special sand, mostly used in glass making, sand blasting, filters, and foundry processes. Sacramento County produces no special sand. The most commonly

used concrete aggregate has always been sand and gravel, which is the only natural granular aggregate that is at once abundant, strong and inexpensive.

Concrete is made by mixing aggregate with some binding material, usually portland cement, in varying proportions depending on how strong the end product has to be. A rough guide is that concrete consists of about one part cement to two parts sand and four parts gravel. These proportions are based on the principle that there must be a sufficient amount of cementing material to coat all the particles of both fine and coarse aggregate, and a sufficient amount of fine aggregate to fill all the voids between the fragments of coarse aggregate.

To be suitable for use in portland cement concrete, aggregate must be composed of clean, uncoated, generally round-shaped particles which are sound and durable. Soundness and durability are qualities necessary in the aggregate to assure that the finished concrete retains a uniform physical and chemical state, free from pitting, cracking or excessive wear when exposed to weathering and other destructive processes. Individual particles must be tough, firm, and strong enough to resist stresses, and physical and chemical changes such as swelling, cracking, softening and leaching.

Harmful surface coatings, like clay or opaline silica

which would prevent a strong bond with the cement, should not be present on the grains. The aggregate should be free of excessive amounts of silt, clay, mica, organic matter, and chemical salts, any of which might reduce the strength of the concrete. Mineral or rock particles that are physically weak, extremely absorptive, easily cleavable, or swell when saturated are unsuitable as commercial aggregate.

IMPORTANCE OF AGGREGATES

Aggregates are an important, fundamental building material. The extensive use of aggregates in our urban environment virtually makes each one of us a consumer. With few exceptions, the market demand for sand and gravel products increases as development and population densities increase. This relationship has been true, for the most part, in Sacramento County.

From 1880 to 1951, some 22 million short tons of sand and gravel were produced in Sacramento County. Over 47 million tons were produced from 1952 to 1961, and 55 million tons from 1962 to 1971. (Figure 1 shows the gross production on a year by year basis from 1948 to 1972). The increase can be partially explained by Figure 2, which shows an increase in the County's population over the years, and Figure 3 which shows a gradual increase in per capita consumption.

Aggregate Resource Study

TOTAL SAND AND GRAVEL PRODUCTION FOR SACRAMENTO COUNTY

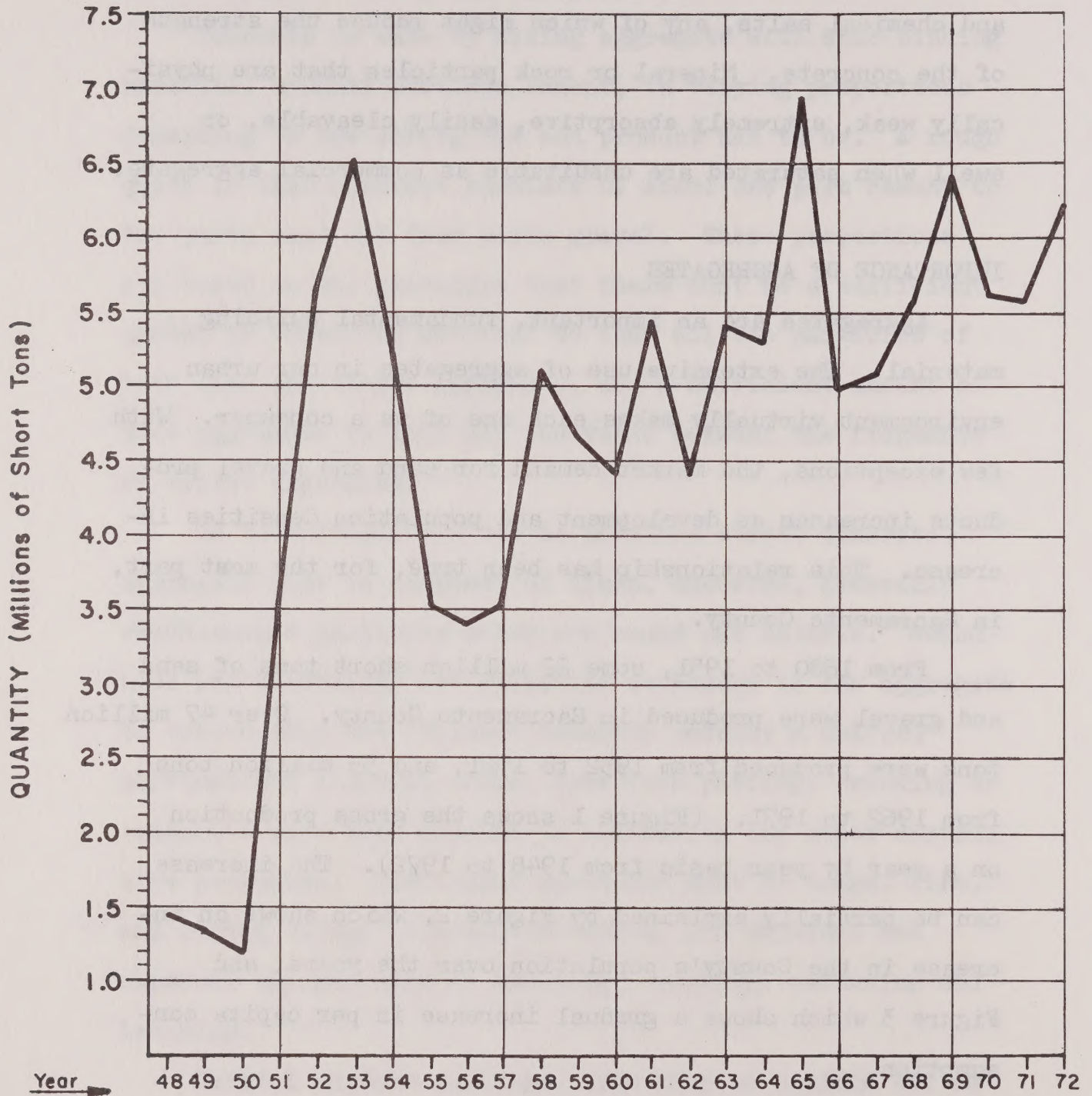


Figure 1

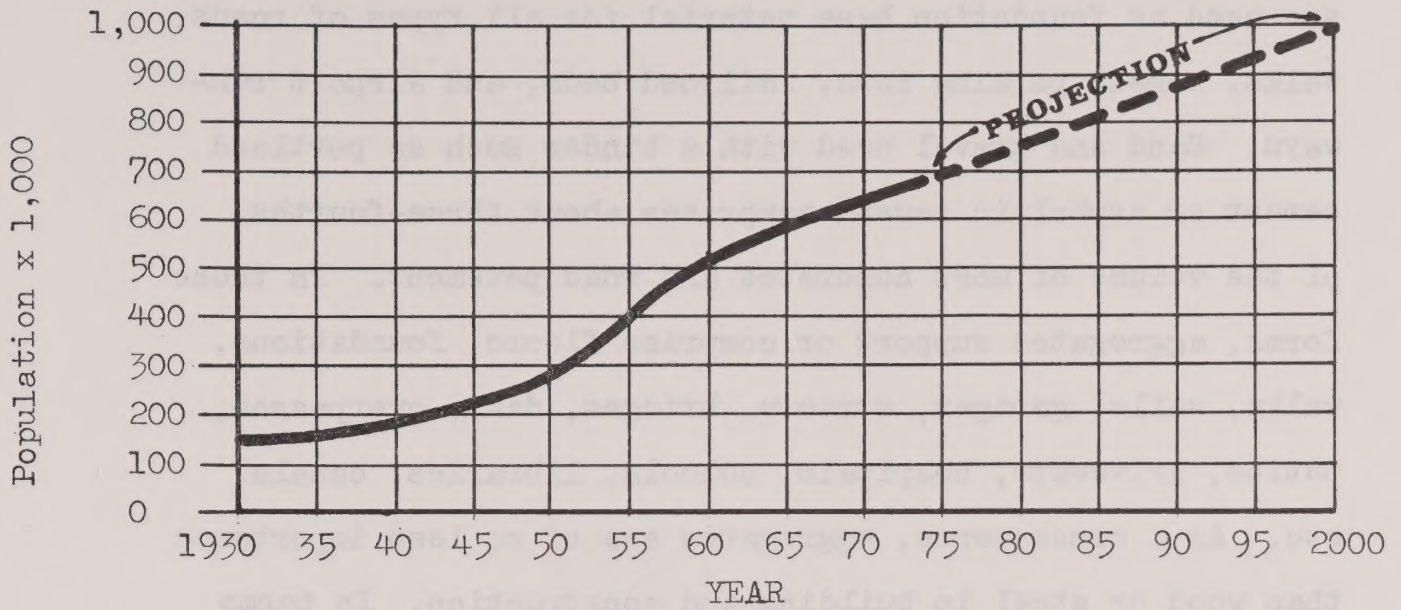


Fig. 2 Sacramento County Population

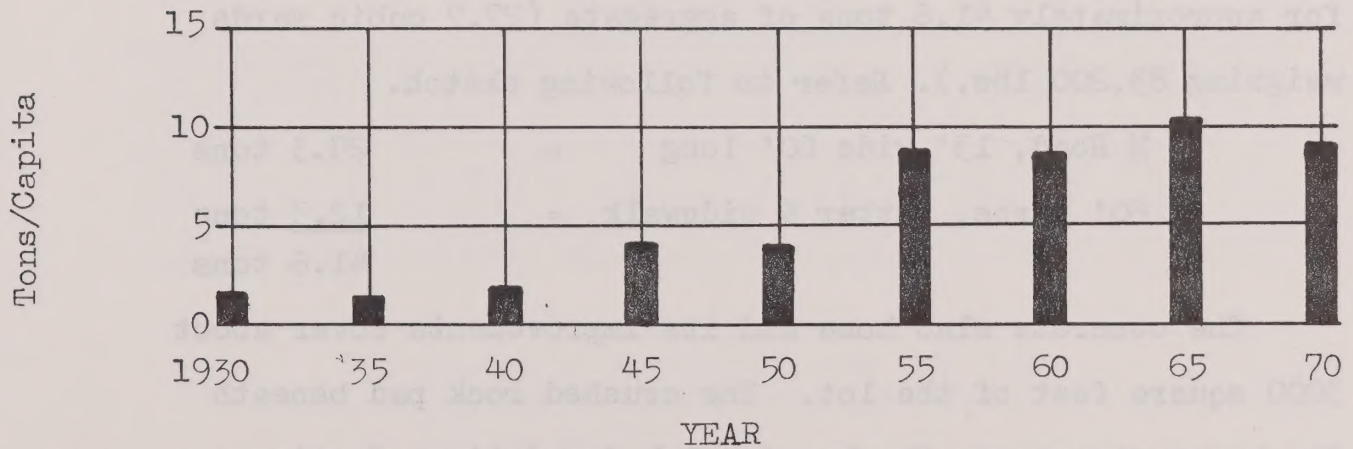


Fig. 3 Approximate per Capita Aggregate Consumption, Sacramento County

Aggregates in loose form without a cementing binder are used as foundation base material for all types of roads, walks, homes, parking lots, railroad beds, and airport runways. Sand and gravel used with a binder such as portland cement or asphaltic cement comprises about three-fourths of the volume of most concretes and road pavement. In these forms, aggregates support or comprise floors, foundations, walks, walls, garages, streets, bridges, dams, overpasses, patios, driveways, hospitals, schools, libraries, canals, etc. As a consequence, aggregates are of no less importance than wood or steel in building and construction. In terms of volume and price, there is presently no economic substitute for aggregate products.

As an example, a typical 1200 square foot concrete slab home on a 60' x 100' lot represents a considerable amount of aggregate when taken on a whole. Public improvements which provide access directly in front of a lot account for approximately 41.6 tons of aggregate (27.7 cubic yards weighing 83,200 lbs.). Refer to following sketch.

½ Road, 13' wide 60' long	=	29.3 tons
60' curbs, gutter & sidewalk	=	<u>12.3</u> tons
		41.6 tons

The concrete slab home and its improvements cover about 3000 square feet of the lot. The crushed rock pad beneath the house structure, the home's slab foundation, footings,

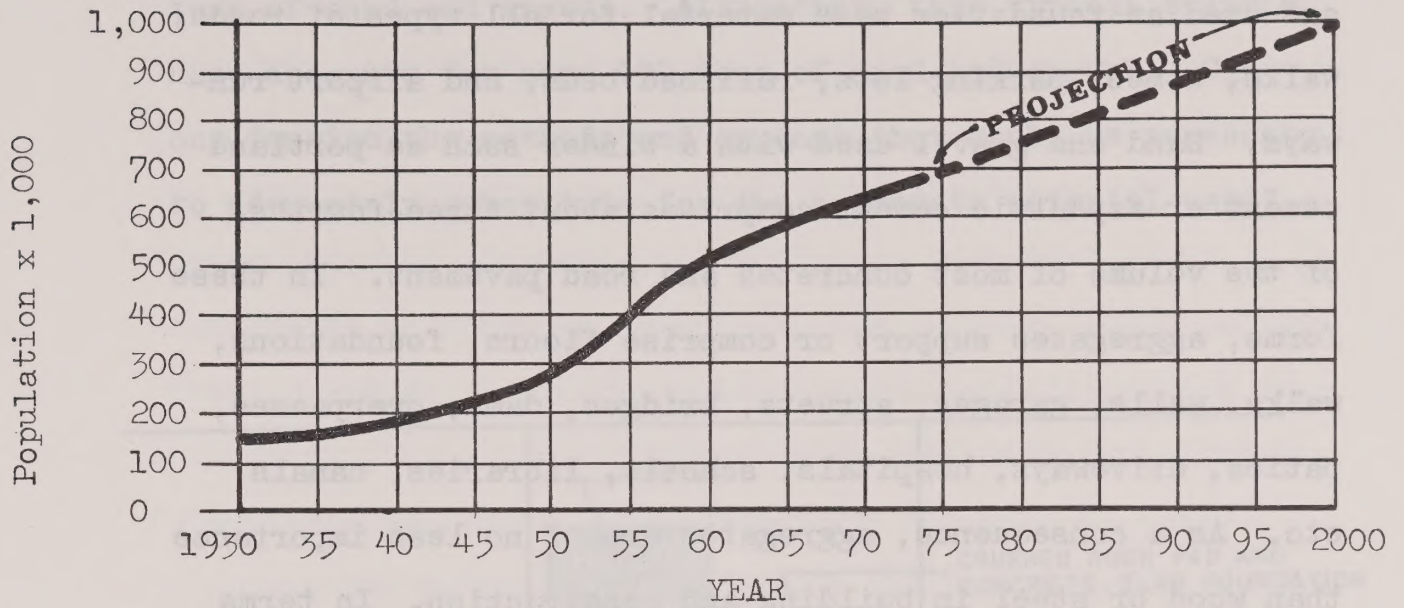


Fig. 2 Sacramento County Population

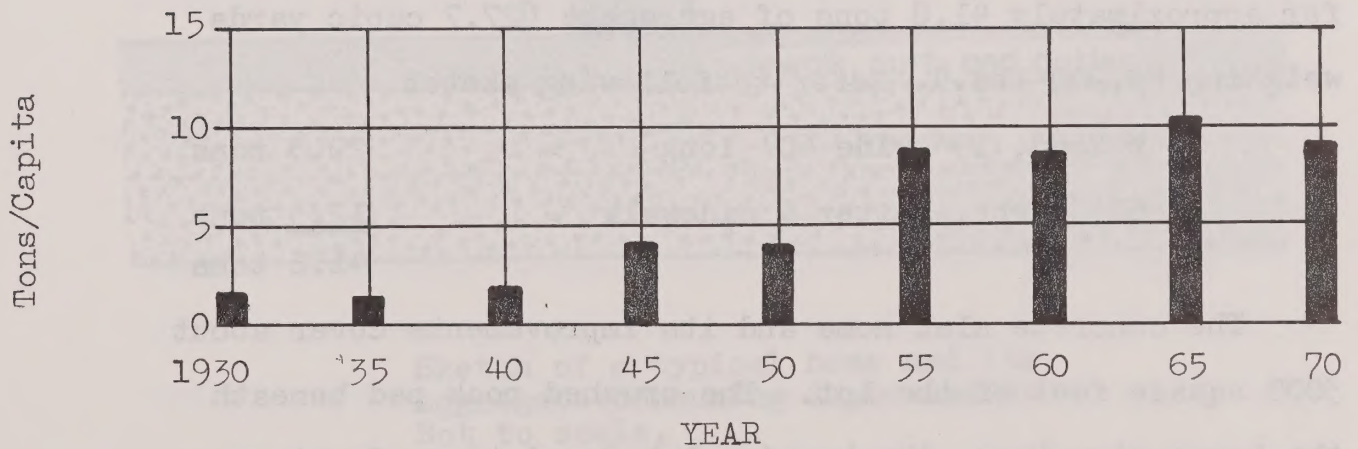


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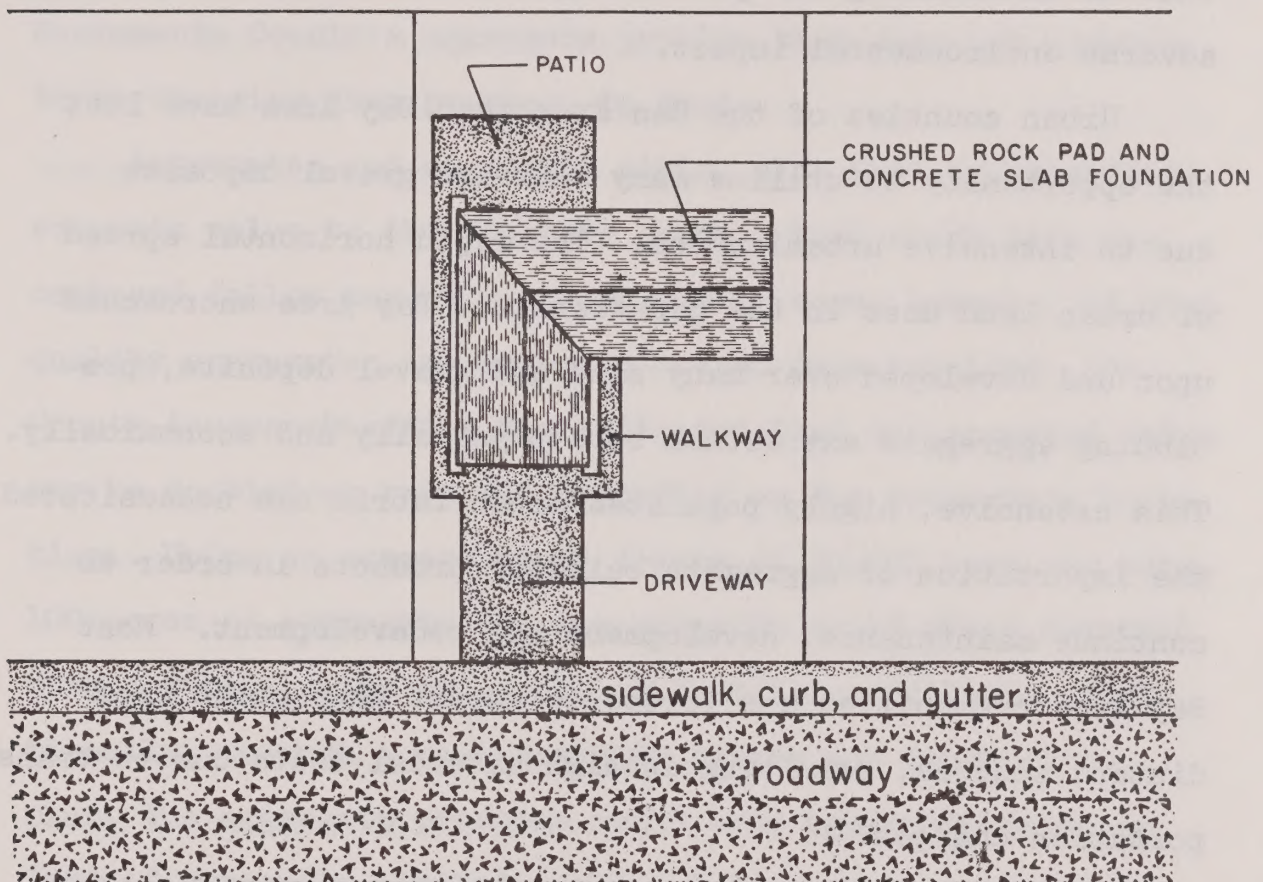
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		41.6 tons

The concrete slab home and its improvements cover about 3000 square feet of the lot. The crushed rock pad beneath the house structure, the home's slab foundation, footings,

garage floor, driveway, patio and walks require about 59 tons of sand and gravel. Altogether, this typical example home accounts for some 100 tons of sand and gravel. Can one imagine the methods and expense that would be necessary to adequately substitute for the aggregate material used?



Sketch of a typical home and its aggregate consuming improvements. Not to scale.

The importance of aggregate as a basic building and maintenance material for both public and private projects makes the management of sand and gravel deposits an important responsibility for the County. Since aggregates are an integral part of urban America, and are expected to remain so, the identification and preservation of lands which may bear high quality sand and gravel products is as important as controlling and preventing nuisances, hazards, and adverse environmental impact.

Urban counties of the San Francisco Bay Area have lost the opportunity to utilize many sand and gravel deposits due to intensive urbanization. The rapid horizontal spread of urban land uses in the San Francisco Bay Area encroached upon and developed over many sand and gravel deposits, precluding aggregate extraction both physically and economically. This extensive, highly populated urban fabric has necessitated the importation of aggregate building products in order to continue maintenance, development and redevelopment. Most Bay Area communities are forced to import aggregates from distant sources, resulting in high material costs due to transportation charges.

Sacramento County statistical data, as projected by the State Division of Mines and Geology, indicate the County will face a similar predicament in a few years, unless effective measures are applied to manage local sand and gravel resources.

It is evident today that hundreds of acres of potentially minable resources have been lost to urbanization in prime aggregate localities in the Perkins-Kiefer area of Sacramento County. If not changed, the existing land use plans and zoning allow and encourage industrialization that will eventually preclude aggregate mining in that area. The possibility of a serious shortage of high quality aggregate resources within economical haul distances is one aspect of Sacramento County's aggregate problem that even now appears to be changing from prophecy to fact.

Aggregates and aggregate mining also have an important economic value to the property owner. Land which lies vacant and fallow may be worth \$2,000 an acre; however, if high quality aggregates are being recovered from the land, the County Assessor's office has indicated that its assessed value may be doubled or tripled, depending on the property's location. Using an average yield figure of 50,000 tons per acre, 100 acres of aggregate bearing property could yield material with a retail value in excess of 15 million dollars. Additionally, through a well designed mining and reclamation plan, the aggregate producer could take aggregate resource land of extremely limited potential for non-mining purposes (e.g., dredger tailings) and convert it to profitable commercial, industrial, recreational, or residential development.

Aggregates are important to the individual consumer,

to the County, and to the property owner. The beneficial, manifold importance of aggregates should be justly recognized in County policy and regulatory measures, so that decisions and actions are as free as possible from ignorance and/or bias.

AGGREGATE STANDARDS

To ensure that portland cement concrete, asphalt concrete and other end products that use sand and gravel are strong, sound and durable, minimum seismic, impact and other specifications have been established by the various agencies responsible for the quality control of the end products. These specifications, which cover both physical and chemical characteristics of sand and gravel, are based on rigorous tests of end products, and of the raw aggregate under various conditions in the laboratory and in the field. The specifications are designed to assure that the physical and chemical properties of sand and gravel to be used as aggregate are satisfactory. The more common tests are for soundness, abrasion resistance, organic content, size grading, specific gravity, absorption and alkali-aggregate reactivity. The procedures used in these tests are outlined in Appendix A.

Aggregates for portland cement concrete are evaluated by eight general characteristics. The first characteristic is abrasion resistance, an essential quality when aggregate

is used in concrete subject to abrasion as in highway surfaces, spillway linings, and heavy duty service floors. The abrasion resistance, sometimes called the durability index of an aggregate, is often used as a general measure of the overall quality of the aggregate. Because of advanced chemical weathering due to their relatively older age, the material of about two-thirds of all the dredger tailings here in Sacramento County do not have a very high abrasion resistance. The current specifications for abrasion resistance rule out the use of most of these dredger tailings as a source of aggregate for use in portland cement concrete.

The second characteristic, especially important in exposed concrete in regions of freezing weather, is freeze-thaw resistance. The freeze-thaw resistance depends upon the sand and gravel's porosity, absorption and pore structure. If an aggregate particle absorbs too much moisture, the water expansion which occurs during freezing cannot be accommodated and particle failure results. Extensive particle failure will result in the disintegration of the finished concrete.

Aggregate possessing chemical stability, the third characteristic, will neither react chemically with cement in a harmful manner nor be affected chemically by other external influences. Some rocks and minerals undergo chemical reactions when incorporated into concrete with normal portland cement. The most important reaction, called alkali-

aggregate reactivity, occurs between certain glassy, siliceous types of aggregate particles and the alkali of the wet cement. The product of this reaction is a silica gel that absorbs water and swells, causing expansive pressures and the cracking of concrete. The tests for alkali-reactive aggregates are of primary importance because these reactive materials may cause abnormal expansion, possibly causing "pop-outs" of concrete. In Sacramento County, low alkali content Type II portland cement is used to control problems resulting from the small percentage of alkali-reactive particles present in local aggregates.

The fourth characteristic, grading or particle size distribution of aggregates is determined by a sieve analysis, in which material is sifted through a stack of screens of progressively smaller mesh. Limits are specified for the percentage of material passing each sieve. There are several reasons for specifying grading limits and maximum aggregate size. The grading and maximum size of aggregates affect relative aggregate proportions as well as cement and water requirements, workability, economy, porosity, and shrinkage of the finished concrete.

The fifth characteristic concerns the shape and surface texture of the particles. These properties influence the properties of freshly mixed concrete more than of hardened concrete. Rough textured, or flat and elongated particles

require more water to produce an equally workable concrete than do rounded or cubical aggregates. Unless additional cement is used, the wetter mix results in concrete of lower strength.

The sixth characteristic, unit weight, is important in concrete mix design calculations and concrete density classification. Bulk unit weight of an aggregate is the weight of the material required to fill a one cubic foot container.

The seventh characteristic, specific gravity, is not a pure measure of aggregate quality. Specific gravity is used in certain calculations for mix design and control. The normal weight of most sand and gravel is 2.4 to 2.9 times heavier than an equal volume of water.

The eighth characteristic of sand and gravel, the amount of absorbed and surface moisture, is important so the net water content of the concrete mix can be controlled and correct batch weights determined. This characteristic is an expression of the internal and surface wetness of the particles.

Besides the above eight characteristics which are closely observed, other specifications also limit the amounts of deleterious substances that may be present in aggregates. These include: organic impurities, clay, silt, lightweight minerals, and soft or friable particles. All of these sub-

stances adversely affect the strength and durability of concrete and must be removed or kept to low tolerances by the producer to meet specifications.

Asphaltic concrete aggregate used predominantly for pavement must meet the same general physical requirements as portland cement concrete aggregate, as to strength, durability, and resistance to wear. The main difference is that asphaltic concrete aggregate favors broken-surfaced particles over smooth ones, and a higher proportion of fine-grained particles is allowable.

The quality standards for sand and gravel are intended to ensure a minimum level of performance from aggregate products, but these standards also have an exclusionary effect on deposits of sand and gravel which cannot meet the requirements without costly additional processing.

According to authorities of the State Division of Mines and Geology, the combined effect of quality standards, market conditions, and processing technology, makes production of high quality aggregates from many areas in Sacramento County unfeasible.

AGGREGATE PROCESSING

There are three major and several smaller producers of sand and gravel in Sacramento County. A few of these are:

- A. Granite Construction Company
- B. Harms Brothers
- C. Lone Star Industries
- D. Operating Engineers (Rancho Murieta)
- E. Teichert Aggregates

Besides processing aggregates, most of these firms also manufacture asphaltic and portland concrete. The basic operations of a typical sand and gravel plant include mining, crushing, washing and screening of the aggregates; some hot asphalt batch plants and concrete batch plants are located on the same sites as the aggregate plants. Other batch plants are distributed near the market area. In Sacramento County the sand and gravel processing plant typically operates approximately eight to sixteen hours per day, five to six days per week, with 80% of the yearly production in the construction season from April to October. Production varies between 400 and 1,000 tons per hour for the three larger plants in the County.

Plant operators are largely concerned with minimizing costs in a process that excludes all extravagances. Attention is directed to minimizing machinery maintenance costs through process simplification, and through the best choice of raw materials and plant equipment. The operator is also primarily concerned with processing the raw materials to meet uniform product specifications at the least cost possible.

Besides undesirable particles, unwanted impurities may occur in the form of roots and other organic matter, or clay layers in the dredged or ponded deposits, or perhaps shells in gravels of marine origin. The impurities must be removed if user specifications are to be met.

The mining of raw materials begins with the stripping of all soil material covering the deposit. This overburden may be stockpiled for later use in reclamation, or sold as fill and topsoil, or used in the construction of dikes and berms. Next the sand and gravel is loosened by rippers or directly scooped by power shovels, drag lines or front loaders, and is loaded into large trucks or onto belt conveyers that haul it to the crushing and grading operation. Little dust is emitted in this harvesting process due to the usually high moisture content of the freshly mined material. The haul roads across the surface mined are usually unpaved and dust is stirred up unless they are constantly wetted by a water truck.

The freshly mined material consisting of soil, sand and gravel is dumped into a large surge pile which feeds the processing plant at the starting point of the crushing and grading operation. The primary screening operation begins by segregating the mined material into three major fractions: sand, gravel, and gravel too large to be economically crushed, called cobble. Size classification is achieved by

a variety of equipment, depending on the particle size involved. Particles in the range of one and one-half inches to three-sixteenths of an inch in diameter are separated in narrow size fractions such as one and one-half to three-fourths, three-fourths to three-eighths, and three-eighths to three-sixteenths of an inch, generally using vibrating screens. Coarse sand suitable for the preparation of concrete is separated from material passing through the smaller screens.

The large cobbles are conveyed to a separate stockpile with no further processing. The sand fraction is washed to remove undesirable silts and clays, dewatered, conveyed and placed in stockpiles. This washing is done in what is called the "wet" side of the plant. There is little or no dust emission from this part of the plant because water spray bars are used on all transfer points and screens to wash off clay and silt. When dumped in the storage piles, the material processed on the wet side of the plant is used in making portland cement concrete. The large stockpiles of materials can become a source of dust when the wind blows strong enough for the material to dry and become airborne.

It rarely happens that an exact balance can be maintained between the total tonnage of raw material entering the plant and the various products leaving it, even in the long term. In Sacramento County, the coarser sizes are in abundance;

therefore, it is necessary for plants that have an excess of coarse material to decide whether to crush it into finer sizes or to discard it as waste. Equally, when there is an excess of finer sizes, some means of disposing of them must be devised. In Sacramento County, typically, the relative shortage of finer particles, requires "make-up" amounts to be imported from other areas to blend with the coarse materials to avoid discarding them.

A portion of the gravel fraction larger than the portland concrete aggregate is not sent to the "wet" side of the plant but to the crushing or "dry" side of the plant. There the larger particles are reduced in size by a combination of three to four jaw and gyratory crushers. All of the gravel goes through three to eight screening operations to be segregated into stockpiles by particle size. Crushed gravel is essential in the composition of different grades of asphaltic concrete. It is important that it remain dry to bond properly with the asphalt. Due to this requirement, the crushing, screening, conveying and dumping of crushed gravel is a dusty operation. The most modern air pollution control for this part of the operation would utilize a baghouse, and vacuuming enclosures on the crushers, screens, and transfer points. The use of a baghouse or its equivalent is required under the County Air Pollution Control permit system for new installations. No practical method has

been devised to collect the dust emitted when the crushed gravel is dumped from the conveyer belt to the sales yard stockpile.

Impurity removal is practiced to some extent in most aggregate plants. The most frequent impurity - clay adhering to the gravel particles - is removed by intensively washing the material in such devices as log washers, and scrubbers. These serve to create attrition between the solid particles by tumbling, freeing the clay fraction by a dispersive action. The clay sediment is carried away to settling ponds in the wash water circulating through the plant.

Natural draining of excess water from the classified aggregate does not present any severe problems. A few hours plus the effects of gravity are sufficient to remove most of the water from the non-porous, coarse material.

Effluent disposal problems are usually limited to finding a means of discharging the unwanted, undersize silt and clay materials, together with other suspended impurities, into settling ponds. The use of settling ponds to recycle and recover fresh water is a step in conservation and economy.

One or two hot asphalt batch plants are usually located with most large sand and gravel operations. They operate approximately ten to twelve hours per day, five to six days per week, with 80% of the yearly production from April to October. Production varies from 150 to 500 tons per hour

depending on the size of the hot plant.

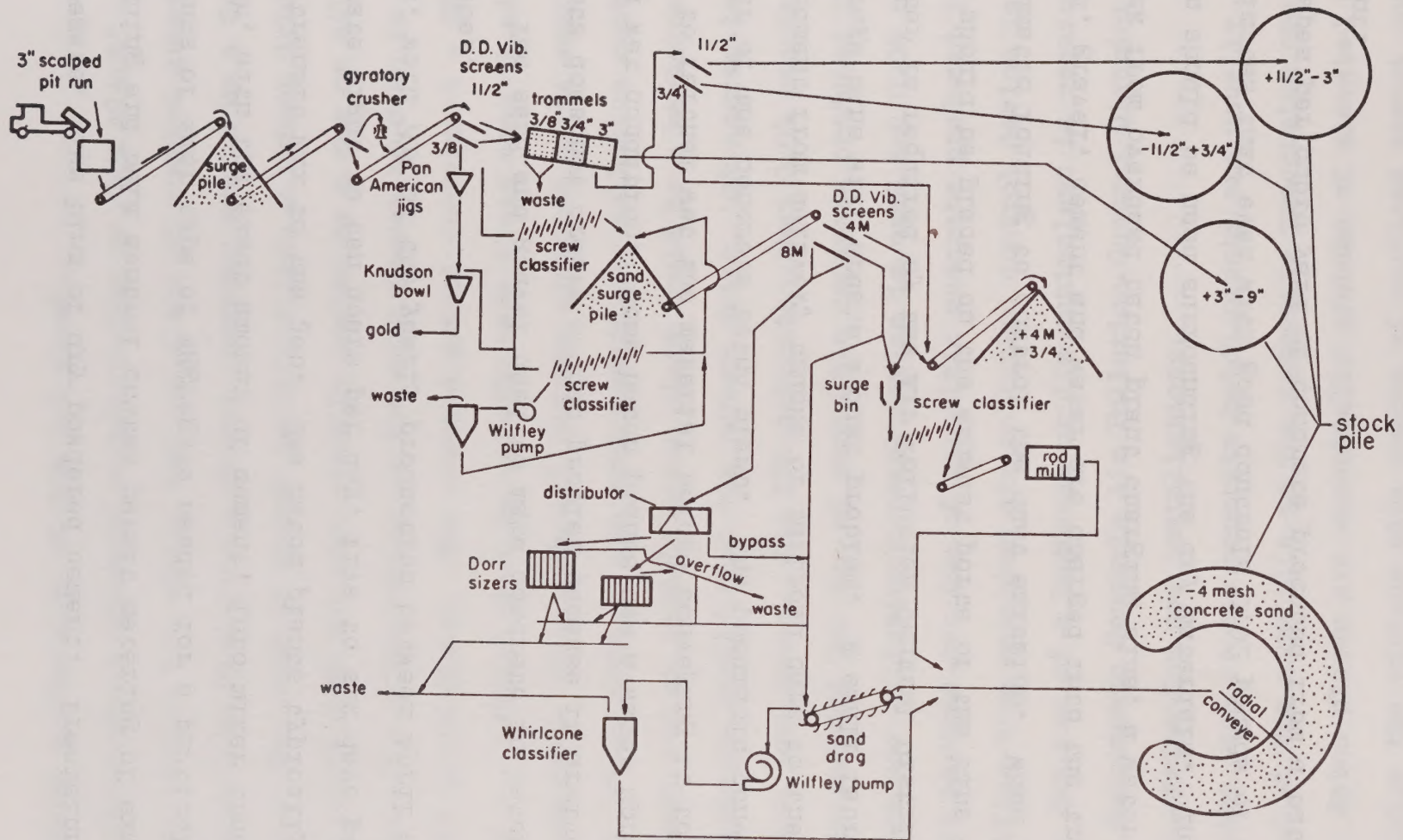
The asphalt concrete manufacturing or "hot plant" process begins by loading various sizes of crushed gravel and sand into bins over a tunnel conveyer system by a front loader. The crushed gravel is lifted into a rotary drier to be dried with hot air, usually heated by a gas or oil burner. The rotary drier is the main source of dust in an asphalt batch plant. The crushed gravel contains 4 - 8% by weight material that is sub-200 mesh (less than 74 microns in diameter). This material becomes airborne quite easily in the rotary drier. The most modern air pollution control equipment for an asphalt batch plant would be a baghouse. The baghouse should vent the rotary drier, hot aggregate elevator, and tower. The EPA estimates that 0.01 pounds of dust is emitted per ton of asphaltic concrete produced if a baghouse air pollution control device is used, and 0.04 pounds of dust escapes per ton of asphaltic concrete produced if an orifice-type scrubber air pollution control device is used. The use of a baghouse or its equivalent is required under Sacramento County's Air Pollution Control District permit system for new installations.

Also, one or two concrete batch plants are usually located at the same site as the aggregate processing operation. Batch plants are essentially systems of elevated bins containing the various size grades of portland cement concrete

aggregate, plus bins of dry powdered cement. Precision weighing and bulk control chutes permit metering of exact amounts of each type of aggregate needed for a particular batch, with the exact amount of cement, into mixer trucks for transit mix to the job. The batch plants typically operate eight to ten hours per day, five to six days per week, with 70% of the yearly production between April and October.

The sand and gravel used to make concrete in batch plants does not create a dust problem because it arrives in a wet condition. Some batch plants use a water spray bar to further wet the material before conveying it to the tower of the concrete batch plant. The pneumatic conveyence of cement from delivery trucks or railroad cars to the storage bins will create a dust problem. A small fabric filter is required by the Air Pollution Control District and should be placed on the exhaust ports of the bins during pneumatic loading to control the dust emission. When the sand, gravel, cement and water are charged into the transit truck from overhead batch plant charging bins, a water curtain should be used surrounding the dry materials. The EPA estimates that even with good controls 0.02 pounds of dust escapes per cubic yard of concrete produced from a batch plant.

Aggregate Resource Study



Flowsheet of a large sand and gravel operation.

FIGURE 4

CHAPTER III

LOCATION-SUPPLY-DEMAND-CHOICE

LOCATION-SUPPLY-DEMAND-CHOICE

Market price, competitive market, and transportation economics are all terms which occur in this report describing, in part, aspects of the American free market system as it applies to Sacramento County's aggregate market. Between these three factors exists a sensitive issue which deserves examination: Does the aggregate consumer really shop in a market of competitive choices?

To be able to approach this issue, the aspects of location, supply, and demand should be focused upon first. The location of aggregate resources and their processing plants is an extremely important factor because the distance between the product source and the customer is one of the main determinants in the cost of aggregates. Since transportation costs are a significant part of the delivered market price of aggregates, the utilization of resource deposits nearest to the consumer is highly desirable. Generally, producers of aggregates nearer the consumer can offer more competitive (lower) prices than can more distant sources. Local sand and gravel operators feel that any haul distance in excess of twenty miles over than of an existing source would require a price too high to be competitive. Ideally from a consumer viewpoint, it is more beneficial to have the aggregate market served by a broad distribution and number of strategically located aggregate producers since the transportation cost is

minimized. Unfortunately, due to the restricted location of high quality aggregate deposits in Sacramento County, a broad distribution of producers is not feasible; however, the present distribution of producers is relatively equidistant from the market center.

Sacramento's market demand of approximately six million tons of aggregate a year is being satisfied by local sources (i.e., supply) located very near the urban fringe. Whenever one or several of the local operators exhaust their present minable resources, and in relocating are forced farther away from the market center, the remaining operators with aggregate sources near the market would be in a more advantageous business position, and they conceivably could charge more for their products and yet be able to deliver aggregates at lower per ton costs than their more distant competitors, due to differences in transportation costs. All other factors being equal, the aggregate consumer has little choice between near and far sources. The consumer is held by economic logic to patronize the closer sources due to their price advantage. So, although the consumer has a choice, it is "pay this or more." For Sacramento, if the market demand exceeded the local supply, and out-of-county sources were necessary to fill the shortage, the potential for significantly higher prices would be very great. A seller's market would allow local producers to charge as much for their product

as a remote producer who must add the extra transportation costs. Up to now, local production has met demand, and local sources are fairly equidistant from the market center. However, in the near future, there is some question whether the local supply will be able to meet the consumer demand for aggregates since two plants, one at Arden Bar and one in Fair Oaks, will soon be closing down.

Another factor further complicates the County's demand-supply situation: vertical integration of the corporate structure. Of the County's three major aggregate producers, two have major operations in the heavy construction business; thus, these two companies are consumers as well as producers of aggregates. After meeting the needs of their own construction units, their remaining production of aggregates is available to serve as supply for other consumers. The third major producer in the County, with a plant in Fair Oaks providing about 20% of the County's six million ton demand, is not in the construction business. With the expected closing of this Fair Oaks plant in 1975, its many consumers will have to scramble for new sources of supply in a market which will be significantly more advantageous to the remaining aggregate producers.

POSSIBLE ANSWERS

Returning to the original question, "Does the aggregate

consumer shop in a market of competitive choices?", several conditions and qualifiers should be added to provide a more accurate answer.

1. "Yes, possibly," while the Fair Oaks plant is in operation and while construction units of the two other major producers are not the dominating consumers.
2. "Perhaps not," if the two vertically integrated producers should consume as much as one-third to one-half of what they produce, or if any or all three of the major producers should become locked into large tonnage contracts.
3. "Perhaps not," if the County's demand should exceed supply, whether it's caused by increased demand or decreased supply.
4. "Yes, possibly" if County government policy and planning can provide a balanced situation, maintaining the opportunity for local supply to meet non-captive demand, and if competitor sources can be kept relatively equidistant from the market demand.

CHAPTER IV

AGGREGATE RESOURCES

Data has been compiled from all known sources in order to determine where aggregate resources exist in Sacramento County. Great care has been exercised by ARMTAC in screening and analyzing data to select only that material which is substantiated by several methods such as test sampling, ground water well-pump specific yields, well driller's logs and general geological information. These standards of data review were utilized in order to make decisions based on the most reliable and credible information available.

ARMTAC has found that for a substantial part of the County, information on aggregate resources is scant to non-existent; therefore, these areas have been omitted from land use resource management considerations. The committee wishes to emphasize that areas excluded from consideration do not necessarily lack aggregate resources. It means that proof of the presence of aggregate resources is absent at this time.

This chapter presents what ARMTAC has learned about how the County aggregate deposits were formed, and generally where high quality commercial sources of aggregates are believed to be located.

GEOLOGIC OCCURRENCE

Streams draining the Sierra Nevada Range have eroded and transported huge volumes of sand and gravel, and

distributed them downstream in stream channels, floodplains, and adjacent river terraces. Evidence of this process in Sacramento County dates back two to three million years ago, to the Pleistocene epoch, when the high Sierra underwent extensive glaciation. Glacial advances were separated by interglacial periods when the snow and ice all but disappeared. Four glacial and three interglacial periods have been recognized during this epoch. All during these periods of glacial advance and retreat, westward flowing streams, such as the ancestors of the American and Cosumnes Rivers, eroded deep canyons into the underlying bedrock of the Sierra Nevada.

As glaciers and ice caps melted and retreated from the Sierras, the heavy flows of melt waters eroded, transported, shaped, and deposited the huge volumes of sediment. Sand, gravel, cobble, and even the heaviest boulders were easily moved by the fierce drainage flows. During intervals of relatively more modest flow, the rivers carried the smaller, lighter aggregate particles, including silt, clay, fine sands and gravels. The sediment material thus removed from the Sierra Nevada was deposited on the floor of the Sacramento Valley in great quantities. The last major Sierra ice cap melted only 10,000 years ago, leaving the Sierra landscape and that of the County much in its present form.

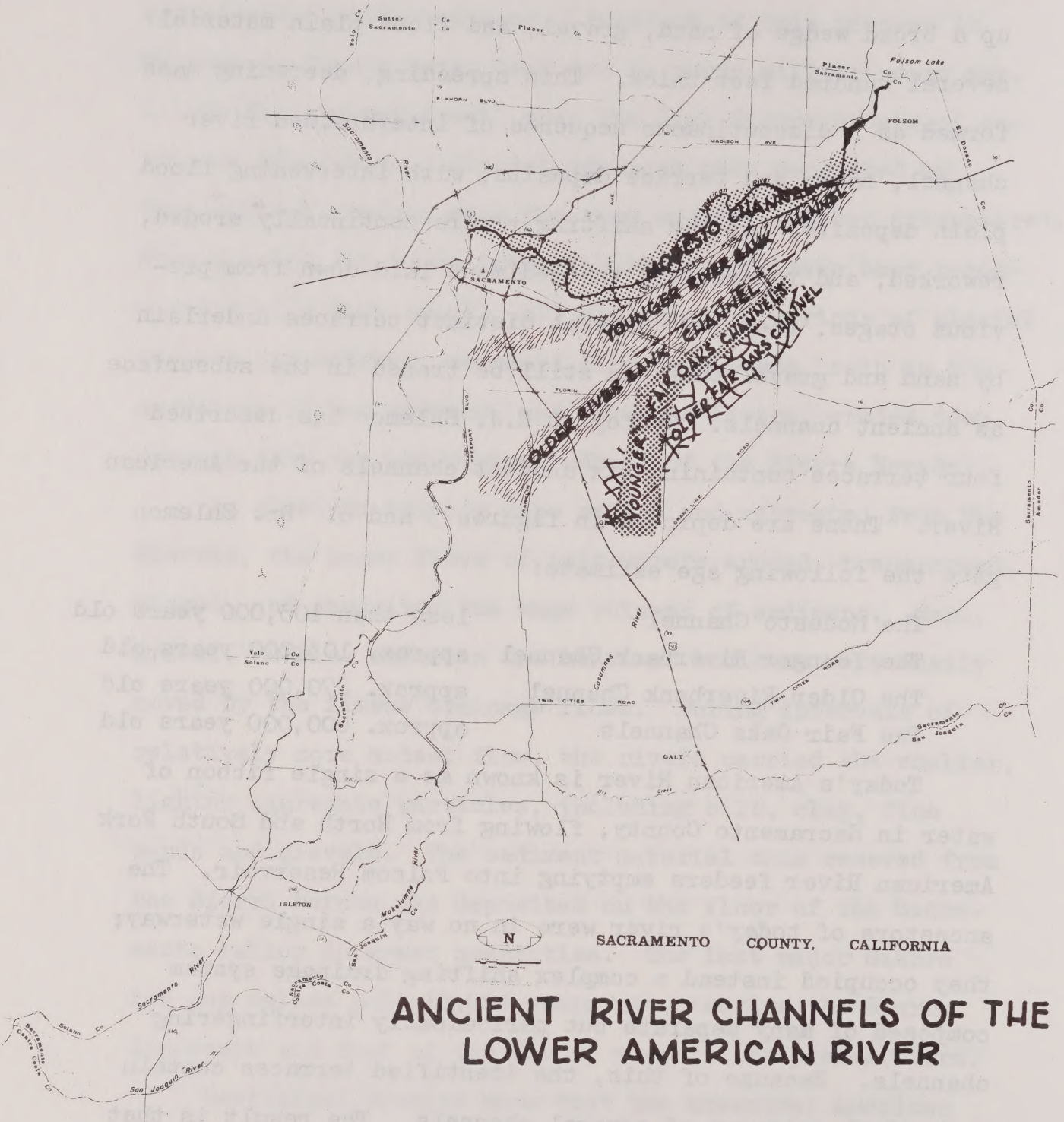
Geological studies show that the ancestral American River shifted its course extensively over the past half-

million years since Pleistocene time, gradually building up a broad wedge of sand, gravel, and flood plain material several hundred feet thick. This spreading, deepening mass formed as a discontinuous sequence of interbraided river channel, bank, and terrace deposits, with intervening flood plain deposits. As the shifting rivers continually eroded, reworked, and redeposited the sediment laid down from previous stages, they left several distinct terraces underlain by sand and gravel that can still be traced in the subsurface as ancient channels. Geologist R.J. Shlemon has described four terraces containing six ancient channels of the American River. These are depicted in figures 5 and 6. Dr. Shlemon gave the following age estimate:

The Modesto Channel	less than 103,000 years old
The Younger Riverbank Channel	approx. 103,000 years old
The Older Riverbank Channel	approx. 270,000 years old
The Fair Oaks Channels	approx. 600,000 years old

Today's American River is known as a single ribbon of water in Sacramento County, flowing from North and South Fork American River feeders emptying into Folsom Reservoir. The ancestors of today's river were in no way a single waterway; they occupied instead a complex shifting drainage system composed of many separate but periodically interfingering channels. Because of this, the identified terraces contain geological evidence of several channels. The result is that although sand and gravel deposits are extensive, their

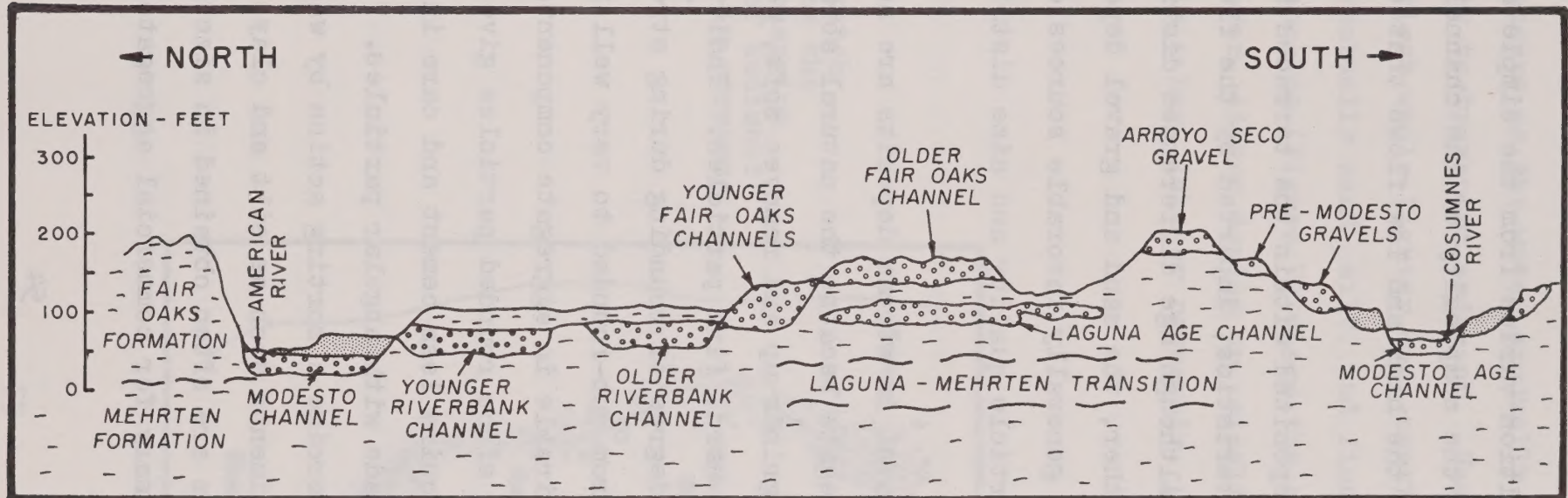
Aggregate Resource Study



SOURCE: THE LOWER AMERICAN RIVER AREA, CALIFORNIA: A MODEL OF PLEISTOCENE LANDSCAPE EVOLUTION BY DR. R. J. SHLEMON. ASSOCIATION OF PACIFIC COAST GEOGRAPHER'S YEARBOOK, 1972 VOL. 34

FIGURE 5

Aggregate Resource Study



Generalized composite structure section from the American River near Fair Oaks to the Cosumnes River showing Quaternary formations and the surface and buried channels. Vertical scale exaggerated.

Source: The Lower American River Area, California: A Model of Pleistocene Landscape Evolution, by Roy Shlemon published in the Association of Pacific Coast Geographer's Yearbook 1972 Vol. 34, Oregon State University Press.

FIGURE 6

Aggregate Resource Study

character and composition varies from the simple and uniform, depending upon the complexity of the channels, the oxbows and branches, the high and low flows that occurred long ago.

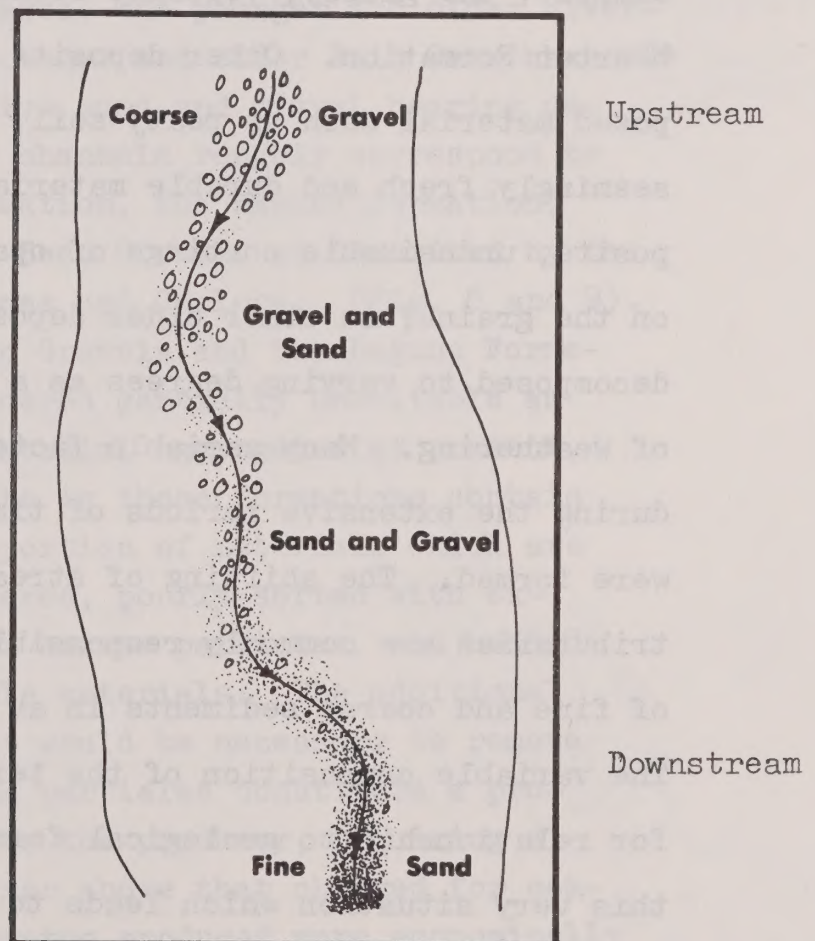
The sediments deposited within the terraces have certain inherent characteristics, imparted by the fluvial action that created them. Although age differences distinguish one channel from another, the sand and gravel deposits created by flowing water are generally favorable sources of aggregates considering particle quality and size distribution reasons.

The sand and gravel in stream deposits are nearly always suited for aggregate because the natural abrasive action of stream transport grinds up and removes soft, weak rocks and concentrates the hard, firm particles. Individual particles undergo some degree of rounding during stream transport and may range from sub-rounded to very well rounded. Such rounding is desirable in aggregate components for portland cement concrete since rounded particles give a more workable mix, and require less cement and care in finishing than does concrete made with angular particles.

Streams also exercise a sorting action by washing away excessively fine sediments such as silt and clay, so that the sands and gravels are often obtained in size gradations close to those necessary for commercial aggregate. The size

gradation occurs as the water gradually loses velocity and its capacity to transport sediment. Heavy materials are deposited first while lighter ones continue farther downstream. Eventually sand, silt, and finer sediments drop out and form deposits (Figure 7) where the stream slows, losing carrying power, either drying up, mingling in a delta or feeding into a bay, lake or reservoir.

Figure 7 Sketch illustrating the gradually changing character of sediment deposition in streams and rivers.



Water volume and velocity of the stream determine the gradation of sediment size, and the distribution pattern of coarse and fine grained deposits along the course of the river from its source to its mouth.

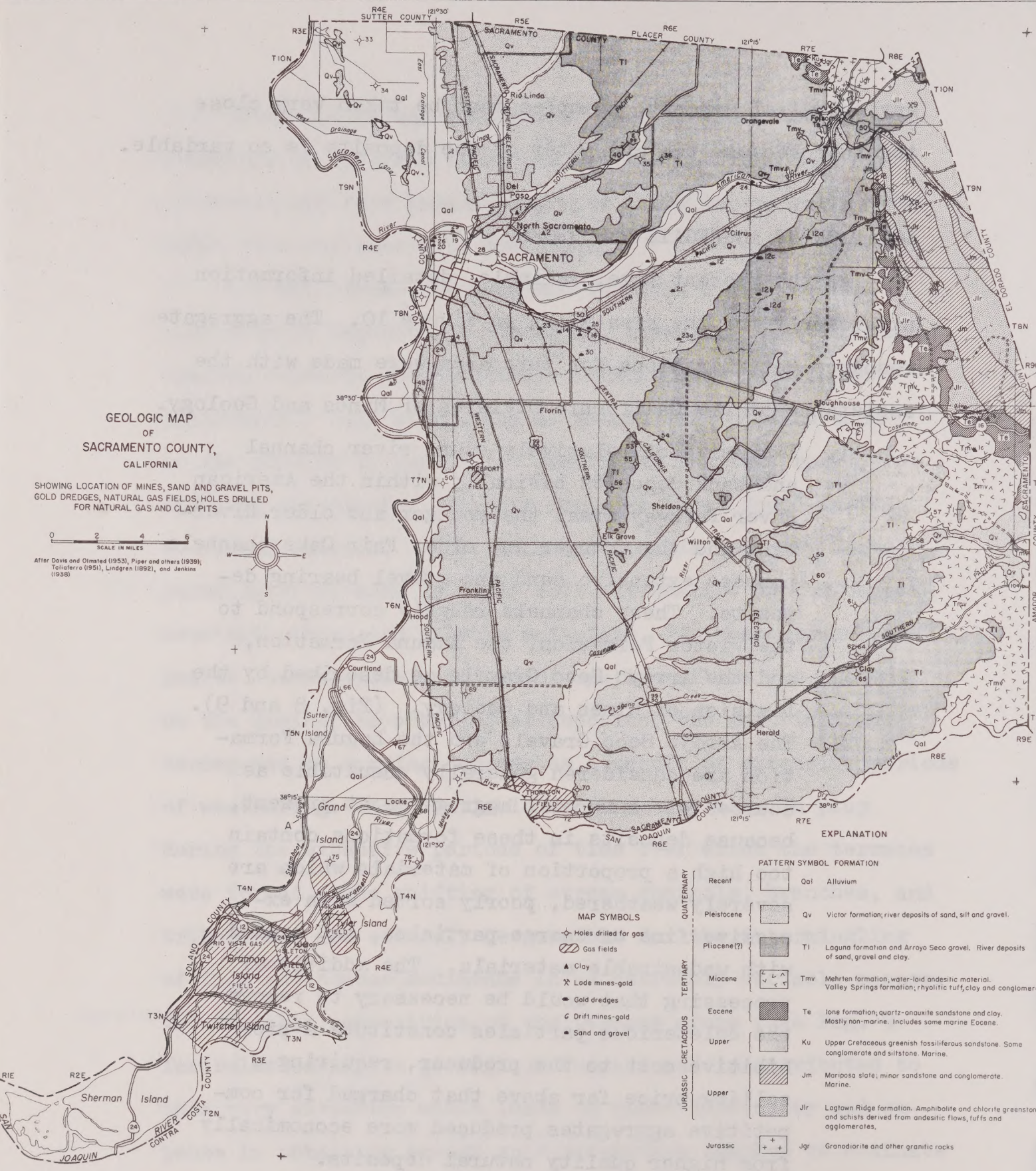
Not all stream channels and terraces in Sacramento bear minable deposits of aggregate, however. Some stream channel deposits are unsuitable because they contain an unacceptably high proportion of harmful ingredients such as the physically unsound or chemically reactive rocks, for example, the glassy, volcanic rocks as those found in the Mehrten Formation. Other deposits contain severely decomposed material such as peaty soil, at shallow depths beneath seemingly fresh and durable materials. In some stream deposits, undesirable coatings of opaline silica are present on the grains; in other older deposits, the materials are decomposed to varying degrees as a result of extensive periods of weathering. Many variable factors have been in play during the extensive periods of time over which the terraces were formed. The shifting of stream channels, branches, and tributaries are commonly responsible for the intermingling of fine and coarse sediments in an extremely variable manner. The variable composition of the terrace areas (see Fig. 9 for relationship to geological formations) is attributed to this very situation which leads to great difficulty and expense in obtaining enough good subsurface samples to evaluate

any potential deposit. Samples must be taken very close together because the character of the deposits is so variable.

LOCATION OF AGGREGATE RESOURCES

At the present time, reliable, detailed information exists only for the area shown on Figure 10. The aggregate resource determinations for this area were made with the assistance of the California Division of Mines and Geology.

1. Exclusive of relatively young river channel and bank deposits basically within the American River Parkway area, the younger and older Riverbank and the younger and older Fair Oaks channels possess extensive sand and gravel bearing deposits. These channels roughly correspond to the Victor Formation, the Laguna Formation, and the Arroyo Seco Gravels as described by the Division of Mines and Geology. (Fig. 8 and 9).
2. The Arroyo Seco Gravels and the Laguna Formation are considered generally unsuitable as sources of commercial aggregates at present, because deposits in these formations contain too high a proportion of materials which are severely weathered, poorly sorted with excessive fine or coarse particles, and bedded with undesirable materials. The additional processing that would be necessary to remove the deleterious particles constitute a prohibitive cost to the producer, requiring a selling price far above that charged for competitive aggregates produced more economically from higher quality natural deposits.



GEOLOGIC MAP
OF
SACRAMENTO COUNTY,
CALIFORNIA

SHOWING LOCATION OF MINES, SAND AND GRAVEL PITS,
GOLD DREDGES, NATURAL GAS FIELDS, HOLES DRILLED
FOR NATURAL GAS AND CLAY PITS

0 2 4 6
SCALE IN MILES



After Davis and Olmsted (1953), Piper and others (1939),
Tallentire (1951), Lindgren (1892), and Jenkins
(1938)

MAP SYMBOLS

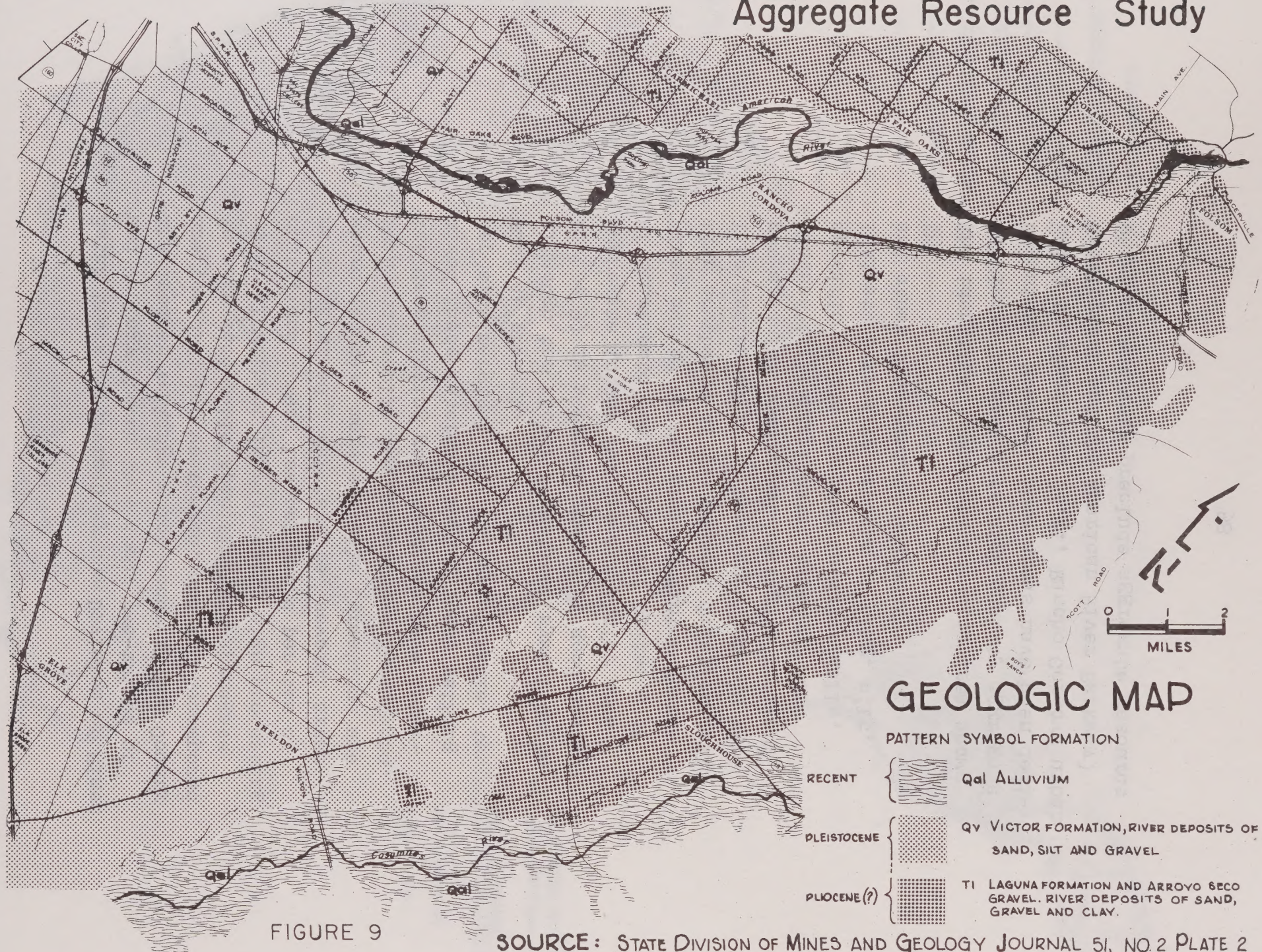
- ◆ Holes drilled for gas
- ▨ Gas fields
- ▲ Clay
- ✕ Lode mines-gold
- Gold dredges
- Drift mines-gold
- Sand and gravel

EXPLANATION

PATTERN SYMBOL FORMATION	
Recent	Qal Alluvium
Pleistocene	Qv Victor formation; river deposits of sand, silt and gravel.
Pliocene(?)	Tl Laguna formation and Arroyo Seco gravel. River deposits of sand, gravel and clay.
Miocene	Tmv Mehrtan formation, water-laid andesitic material. Valley Springs formation; rhyolitic tuff, clay and conglomerate.
Eocene	Te Ione formation; quartz-anaxite sandstone and clay. Mostly non-marine. Includes some marine Eocene.
Upper	Ku Upper Cretaceous greenish fossiliferous sandstone. Some conglomerate and siltstone. Marine.
Upper	Jm Mariposa slate; minor sandstone and conglomerate. Marine.
Upper	Jlr Laguna Ridge formation. Amphibolite and chlorite greenstone and schists derived from andesitic flows, tuffs and agglomerates.
Jurassic	Jgr Granodiorite and other granitic rocks

3. Batch tests supervised by the Division of Mines and Geology proved that about two-thirds of the dredger tailings which occur in the County are too old, too weathered, and too decomposed to make acceptable specification aggregate material without impractically high processing costs, and a very low net yield per ton of material mined. Furthermore, several areas where younger, more suitable formations are thin and overlie the undesirable formations, the deep digging gold dredgers have inter-mixed these materials making these tailing deposits marginal, if not unprofitable, to mine at present.
4. Although the Victor Formation (symbol Qv on Figure 9) is a proven source of good quality aggregate in the Perkins and Kiefer area of Sacramento County, a brief Division of Mines survey of the unmined Victor Formation southwest of the Central Traction rail line indicated it to be a questionable target area for commercial aggregate recovery because inferential data, based on low specific yields observed in water wells, indicate extensive amounts of clay, silt, and other fine-grained sediments.
5. The identified aggregate resource area shown on Figure 10 possesses high quality aggregate deposits. However, some areas have been dedicated to other uses (e.g., Rancho Cordova urban development and the American River Parkway) which effectively preclude aggregate resource

Aggregate Resource Study



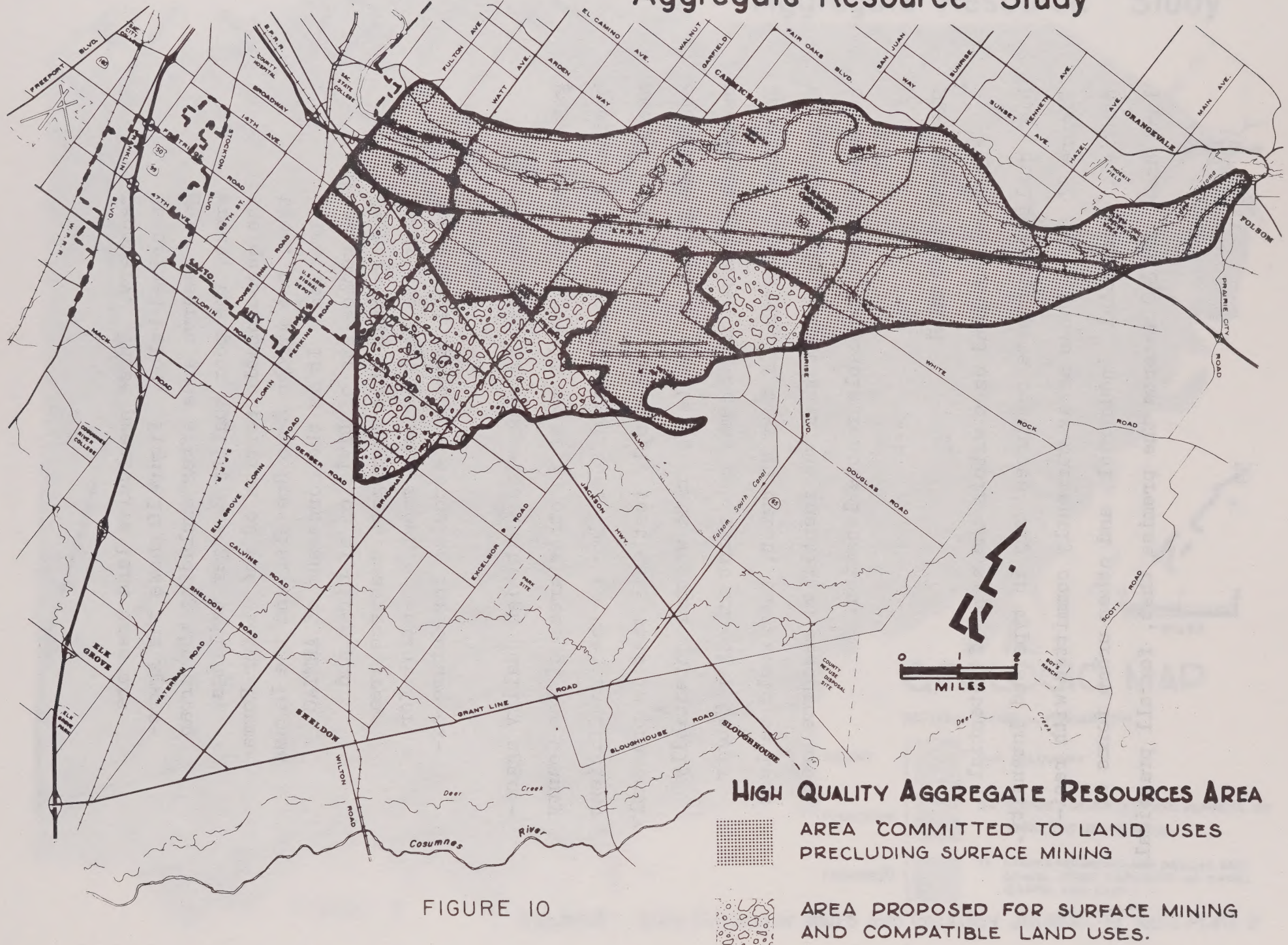
recovery. These preclusive land uses are described below. Figure 10 shows the Aggregate Reserve area after excluding the urban areas, the poor quality dredger tailings, the questionable portion of the Victor Formation, the Arroyo Seco Gravels, and the Laguna Formation. It is the consensus of ARMTAC and geologists of Division of Mines and Geology that this Aggregate Resource area holds the best present known potential for commercial aggregate deposits for future extraction.

It is important to emphasize that high quality aggregate resources may well exist in other areas of the County besides those already identified. Due to the insufficient amount of geological and sample test data that is presently available ARMTAC is unable to state whether potentially useable aggregates may or may not exist in other County locations. However, if they do exist, they would be less economically important than the identified resource area because of their probable remote location.

PRECLUSIVE LAND USES

The present land uses within the area of potential high quality aggregate resources vary in type and intensity. Figure 15 shows those areas currently committed with residential, commercial, industrial, and other urban forms of land use. ARMTAC accepts the premise that, for all practical

Aggregate Resource Study



purposes, aggregate resource deposits existing there have been precluded from extraction due to the presence of intensive development.

Residential development is concentrated on both sides of Folsom Boulevard and extends in a moderately developed pattern of subdivisions from the City of Sacramento eastward to Rancho Cordova. Residential development in the City of Folsom is concentrated close to the old city and adjacent to utility trunk lines. New subdivision activity is filling in the gaps, and open space between developments is rapidly disappearing. Farm houses and one to five acre rural home-sites are scattered south of Kiefer Boulevard, occurring predominantly west of Bradshaw Road.

Commercial or retail land uses are restricted to a thin corridor on the north side of Folsom Boulevard and the City of Folsom. The Placerville Branch line of the Southern Pacific Company parallels Folsom Boulevard, limiting commercial development on the south side of Folsom Boulevard to only a few isolated spots.

The industrial areas include the extensive aerospace industries as well as the industrial corridor within the flight path and primary noise zones of Mather Air Force Base. Intensive industrial land uses are concentrated near the western edge of the Aggregate Resource Area.

The over 5,000 acres of institutional and public land

uses include the large land areas of Mather Air Force Base, the American River Parkway, the County Juvenile Center, Boys Ranch and Bradshaw Road County Government complex. Other public uses included are schools, churches, utilities, public service areas, and state property.

Agriculture is the least preclusive and most compatible land use of the area, but it is no longer the predominant land use of this area. Only modest row crop and truck farming continues with some orchards and irrigated pasture. The area east of Mather Air Force Base is used for winter pasture but lies fallow most of the year.

ESTIMATE OF IDENTIFIED AGGREGATE RESOURCE SUPPLY

37,000	Acres of identified aggregate resources area.
<u>-29,500</u>	Acres already committed to preclusive urban land uses, or in the City of Sacramento.
= 7,500	Acres of relatively uncommitted resource land.
<u>- 700</u>	Acres already mined out.
= 6,800	Gross acres of resource relatively uncommitted to preclusive land uses.
<u>*- 30%</u>	Rural and industrial preclusion and set-back loss over the 25 year period until the year 2000.
Roughly=4760	Net acres of aggregate resource.
	Using an average yield figure of 50,000* tons/acre, the identifiable aggregate resource area represents 238 million tons of material.

*These figures are crude approximations and may vary; however, they represent the closest determination possible at this time based on the information available.

ESTIMATE OF FUTURE AGGREGATE RESOURCE NEEDS THROUGH THE YEAR 2000

The Sacramento Metropolitan Area consumes over 11 times the amount of aggregate in 1974 than it did in 1941. The 1972 figures for aggregate operations in Sacramento County indicate 6,210,000 tons of production. On Figures 1 and 3, the past production figures are shown by gross annual totals and by estimated annual per capita figures. To estimate what the future aggregate production levels will be, these figures and several assumptions were utilized. The assumptions are:

- a) The figures are relatively accurate in reflecting past production levels;
- b) Production closely reflects the Sacramento County demand for aggregate materials;
- c) The importance and use of aggregate as a construction material will not change substantially in the foreseeable future; and,
- d) The population projections made by the County Planning Department are reasonable.

Two statistical calculations were performed to check one estimate of future aggregate demand with another. A set of estimates of future production and demand was calculated from the per capita data for the period 1960-1972 (see fig. 3). After the per capita values were found to be independent statistics from population growth by remaining relatively constant when the County's population increased 30%, the average per capita figure was selected to make the first projection. The average, 9.18 tons per capita, was

multiplied by the population projections of the County Planning Department. A second set of estimates was calculated using a regression equation with the production data shown in Figure 1. The following table shows that both sets of estimates were very close to one another.

Table of Estimated Future Production/Demand
for Aggregate Products Per Year

Year	Linear Regression Method	Per Capita Method
1974	6,354,787 tons	6,281,386 tons
1980	7,001,049 tons	6,802,233 tons
1985	7,540,434 tons	7,362,579 tons
1990	8,079,819 tons	7,948,645 tons
1995	8,619,205 tons	8,428,155 tons
2000	9,158,590 tons	8,926,036 tons

Background
Calculation
Figures

$$r = 0.57$$

$$m = 107,877$$

$$b = -206,595,518$$

$$S.D.Y. = 1,281,026$$

$$\bar{x} = 9.18 \text{ tons per capita}$$

$$S.D. = 1.04 = 11\% \text{ variation from mean.}$$

The more conservative per capita method estimate predicts the County will need a grand total of 191,060,000 tons of aggregate through the year 2000. Assuming an 11% margin for error since the standard deviation for the per

capita average of 9.18 tons was 11%, ARMTAC predicts the Sacramento market from January 1975 to December 2000 will require from 170 to 212 million tons of aggregate products. To meet this market demand from local sources, assuming a yield of 50,000 tons/acre, between 3,400 and 4,200 net acres of aggregate resource must be mined.

IMPORTANCE OF OUT-OF-COUNTY AGGREGATE SOURCES

The nearest sources of sand and gravel outside of Sacramento County are some seventeen to twenty-five miles away. The extra cost of importing large quantities of aggregates to serve the future County needs are estimated to increase the price per ton by as much as 80%. Should local sources be unable to supply enough aggregates to the County market, importation would probably occur from one or more of the identified sources on the following map. Due to transportation costs of such an alternative, the cost of construction and maintenance using sand and gravel would undoubtedly increase proportionally.

When considering out-of-county sources, it is important to recognize that outside sources of aggregate are subject to similar demands and pressures as sources in Sacramento County; consequently, there is no long term assurance that regular importation may be possible.

AGGREGATE RESOURCE STUDY

REGIONAL LOCATION OF MAJOR KNOWN AGGREGATE OPERATIONS

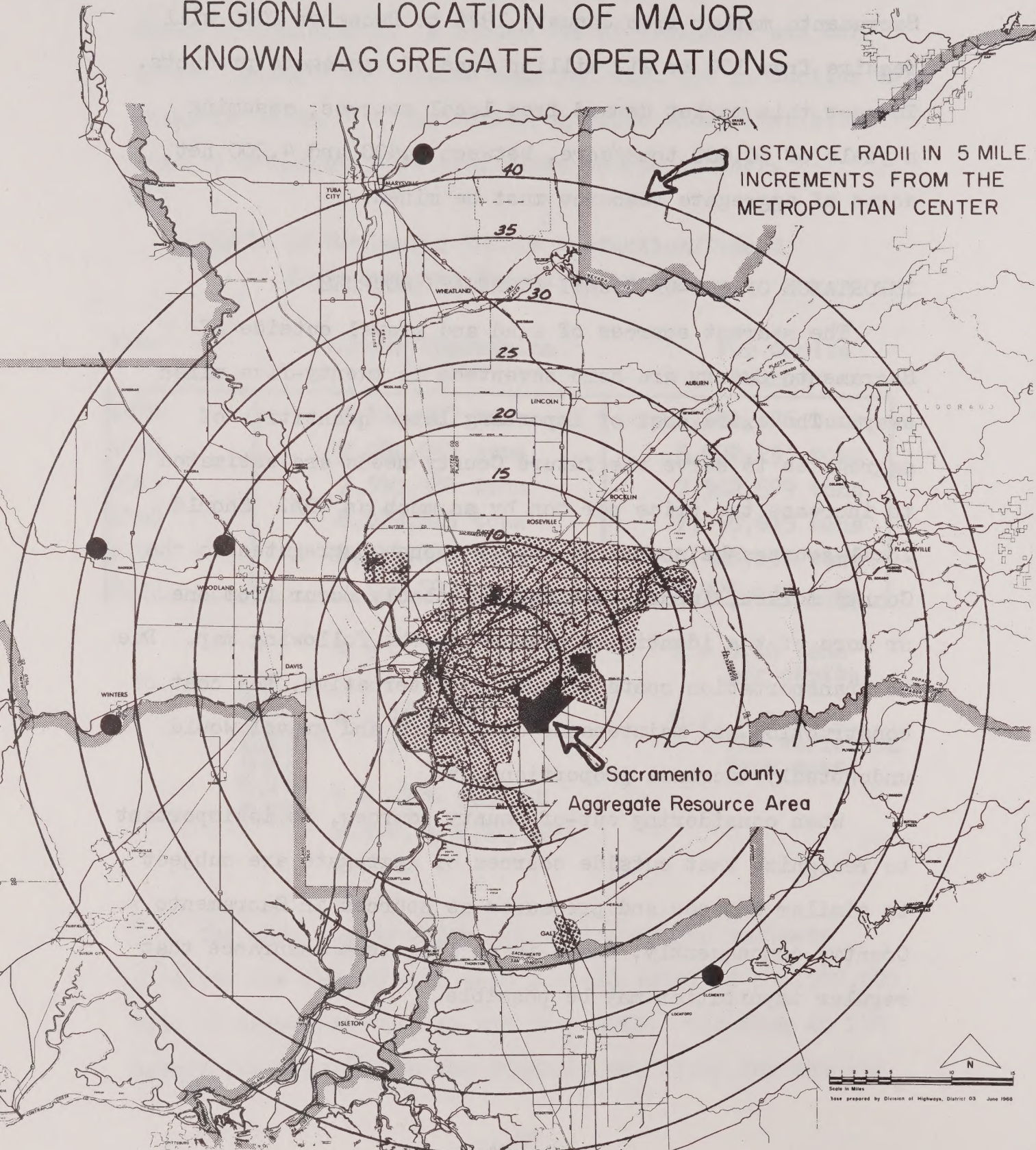


FIGURE 10-A

CONCLUSIONS

It is projected that the County of Sacramento's sand and gravel need for the next twenty-five years through the year 2000 will require the harvesting of aggregates from some 5.3 to 6.6 net square miles of land. If mining setbacks and the minor occurrence of preclusive land uses is presumed, a gross area from 7.6 to 9.6 square miles may be required to satisfy the anticipated need.

Using the best available current information, ARMTAC has identified a resource supply of 7.4 square miles of high quality aggregates within an aggregates resource gross area of some 10.6 square miles (6800 acres). This last figure represents about 1% of the total area for the County. If no land use management measures are adopted to protect this identified resource, it is possible that the importation of aggregates may be necessary to help provide for the County's needs for the next twenty-five years. Careful land use management could well avoid that expensive alternative to satisfy the local market for sand and gravel products.

It is ARMTAC's deep belief that the welfare of the aggregate consuming public would be well served by a land use management program that would protect our finite aggregate resources to carry the local market for another twenty-five years at a minimum.

CHAPTER V

MINING REGULATIONS

PRESENT REGULATIONS AND PROCEDURAL PROBLEMS

In accordance with the third task assigned by the Board of Supervisors (i.e., to assist in the preparation of regulations for sand and gravel operations which will result in a minimum of environmental and operational conflicts), ARMTAC has reviewed the current County regulations and procedures affecting aggregate mining and processing.

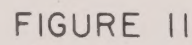
The County of Sacramento has several policies on mineral resources, a zoning code which regulates mining uses, a use permit procedure and zoning enforcement program. A review of their regulatory effectiveness has uncovered several causes for concern:

- There appear to be at least four sites in the County where surface mining is being conducted without a valid use permit.
- Non-uniformity exists in the processing of use permit applications for zones which permit mining.
- No efficient way exists for maintaining records of past issued use permits for aggregate mining.
- The use of vague generalities in the statement of conditions and requirements in use permits makes administration, enforcement and compliance subject to confusion and different interpretations. Neither the citizen nor the aggregate operator knows what to expect nor does the County of Sacramento know exactly where to draw the line on enforcement.
- The administration of use permit applications does not require the aggregate operator to fully

consider the many aspects of operation and reclamation. Often too little information is required to allow the County to fully evaluate the merits and shortcomings of an application.

- The mechanisms for suspension and revocation of use permits are not adequately defined to provide a) an expedient avenue for local government to provide relief to citizens subject to adverse conditions or b) due process to protect the permitted operator from capricious action.
- The absence of any regular or ongoing use permit enforcement program prevents ascertaining evidence whether permitted aggregate uses are or are not in compliance with set conditions.
- The County has no specific goals or policies or criteria for reclamation of lands disturbed by surface mining by which compliance can be evaluated either over the short or long term.
- Most conditions set for reclamation are too broad to ensure a reasonable form and degree of reclamation in the shortest possible time.
- There are no provisions for progressive reclamation, mining setback, controlled grading, land-scaping and erosion control.

PREPARED AUG. 1, 1974



ARMTAC PROPOSED REGULATIONS AND PROCEDURES

The findings above indicate that the County of Sacramento's regulatory approach towards the surface mining of aggregates is in serious need of modification and improvement. A thorough attempt was made in this part of the ARMTAC study to address every aspect of regulation.

Applications for Aggregate Mining Use Permits

The County of Sacramento should make it clearly known that parties who desire to file an application for an aggregate mining use permit must present sufficient information in the application so that the public and officials who review the proposed use can do so easily and efficiently. Since there are many highly undesirable impacts that a marginal aggregate operation can cause, it should be made clear to any and all aggregate producers that the burden is upon them to demonstrate that they can design, operate and reclaim without significant nuisances, hazards or adverse environmental impacts.

To do the above, ARMTAC recommends that the procedures and requirements for filing and obtaining an aggregate mining use permit be standardized and comprehensive. The use permit application should consist of both written and graphic descriptions. As an integral part of the permit application, two plans should be required: a mining plan and a reclamation plan.

Mining Plan

The mining plan should reflect the logical progression of all the operations of the facility. It should include equipment location, stockpiles, settling ponds, interim drainage, deposit locations, progression of stripping, excavating, and cross-sections of elevations. The mining plan should indicate the necessary time lag between mining and full reclamation and between original equipment siting and relocation(s). Special consideration should be given to progress requirements when simultaneous excavation and reclamation is desirable for a planned ultimate use.

Reclamation Plan

Since ultimate land use and reclamation is as important as nuisance control and aggregate recovery to the community, a reclamation plan should be a basic element of the use permit application. The reclamation plan should be designed to provide a mining site land form which is:

1. readily adaptable for alternative land uses;
2. safe with stable waste piles, slopes, and with the elimination of steep-sided pits and holes;
3. free of derelict machinery, waste materials and scrap;
4. revegetated for soil stabilization;
5. free of drainage problems; and
6. coordinated with present and future land use, topography and general environment of surrounding property.

The reclamation plan should indicate anticipated operations, design and location of berming, landscaping, erosion control seeding, filling of low pit areas, the shaping of pit floor, the management of unminable portions of deposit, original, interim and final (rough) slopes and grades, etc. The plan should indicate the nature and sequence of the reclamation measures that would be performed by the operator.

The temporal design of the reclamation plan is an important responsibility of the mining operator. The proponent should propose in the reclamation plan intervals when inspection would be logical by designing the plan with some type of work staging, indicating what reclamation aspects would be complete or underway at stated points in time. This work staging would provide the basis for the County to evaluate and regulate reclamation. Additionally, the work staging would be the basis for establishing performance bond requirements and bonding periods.

When no specific ultimate land use is being proposed in the permit application, the reclamation plan should be designed to emphasize a broad potential of final land uses that are consistent and compatible with existing uses and future planned uses.

The permit application should also include the following soil, geologic, and hydrologic information:

1. Topographic contour maps of the extant terrain and of the terrain following reclamation.
2. An estimate, based on an examination of the site, of the total quantity of constituent materials (sand and gravel, overburden, other) available at the site.
3. Anticipated dimensions of the excavation area, i.e., areal extent and average depth of overburden and resource material.
4. An estimate of the ton per hour plant capacity and the anticipated annual production rates.
5. Description of the equipment and methods used in the resource recovery for the total operation and for each constituent resource (sand and gravel, gold, other).
6. Soil, geologic (especially lithologic), surface and ground water samplings and any studies of the site prepared for project proponent. Any previous studies of the project site or adjacent sites of which project proponent may be aware.
7. Fate of overburden following removal-disposal, sale, storage for later use, other.
8. Description of drainage course alterations and/or diversions.
9. Identification numbers of any wells on the project site and the location of any proposed wells.
10. Source of water; purpose and rate of water use; and description of disposal methods of any water to be used.
11. Source of fill, if any, for reclamation.
12. Identification of all sewage disposal systems on the proposed site.

The following statements are either areas of concern or

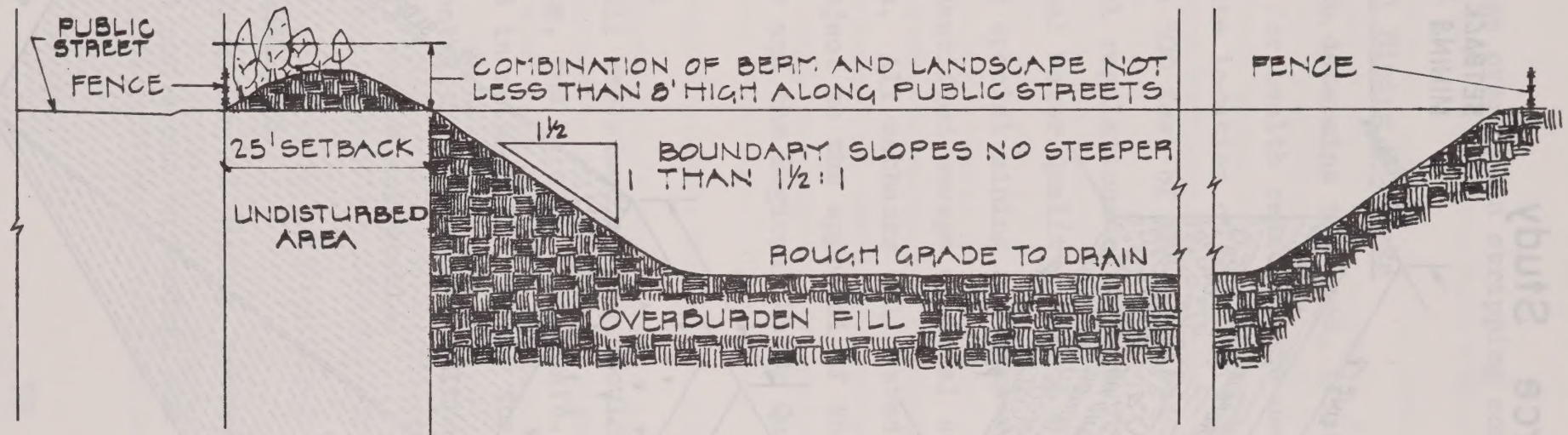
recommended minimum requirements. A permit application should fully address each area of concern as to the measures that will be taken to ensure the least possible nuisance, hazard or adverse environmental impact. The permit application should either incorporate the minimum requirements or fully explain the grounds for proposing any deviation in terms of protecting the community and the environment.

Property Line Mining Setbacks

The mining plan of the permit application should clearly show all setbacks of the minable area from property lines and individual sewage disposal systems. It is recommended that the mining plan designate a minimum setback of twenty-five feet at the periphery of the mining site. In cases where the intended mining site adjoins a public street, (see Fig. 12) it is recommended that the minimum twenty-five foot setback consist entirely of undisturbed land (i.e., no overburden stripping or mining). Along property lines where the proposed site does not adjoin a public street (see Fig. 13), it is recommended that the first five feet of setback consist of undisturbed land, with the balance of the minimum setback consisting of mined and then reclaimed land.

When the minimum twenty-five foot mining setback partially consists of mined land, reclamation should reestablish the setback at its original grade within one year or less from

AGGREGATE RESOURCE STUDY



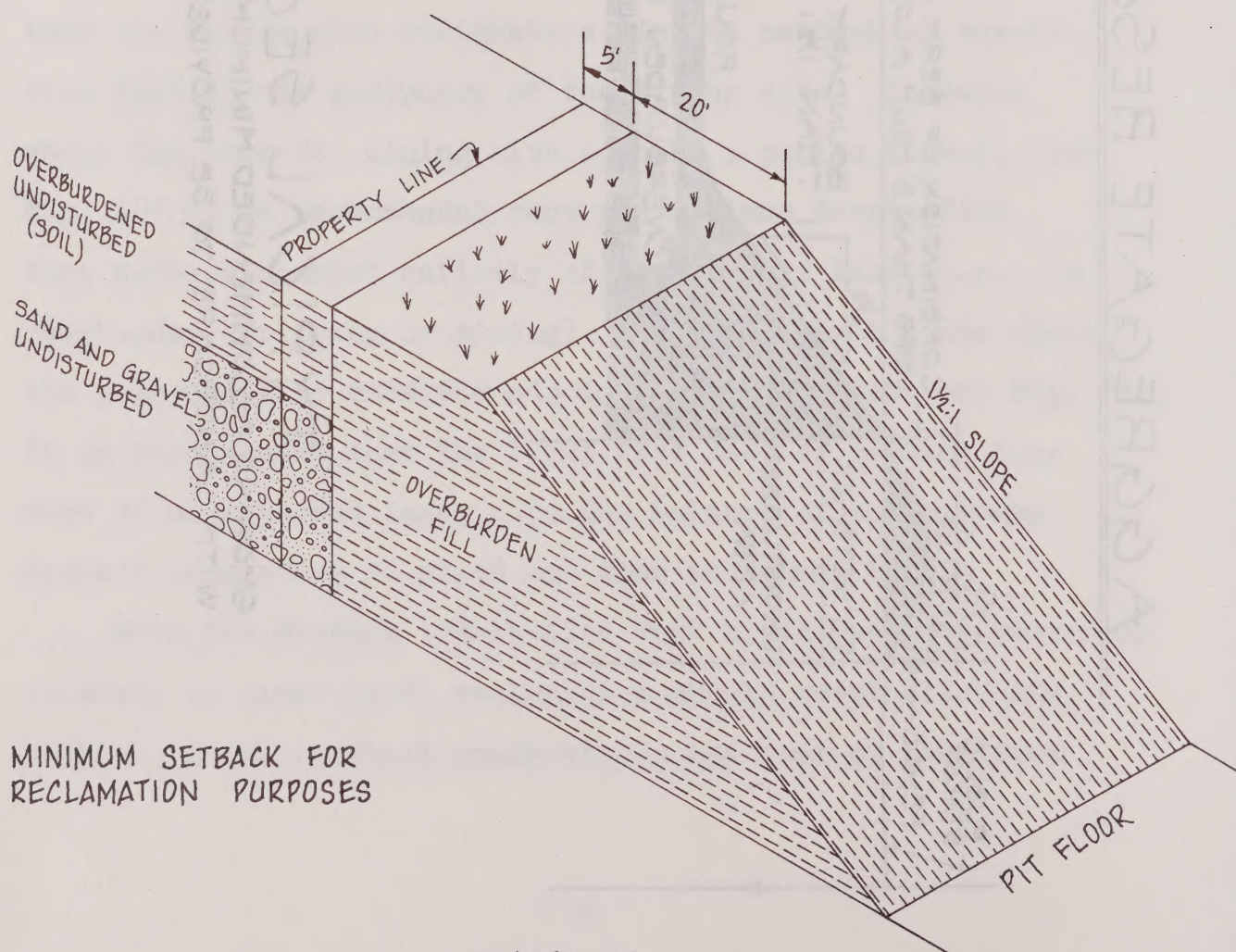
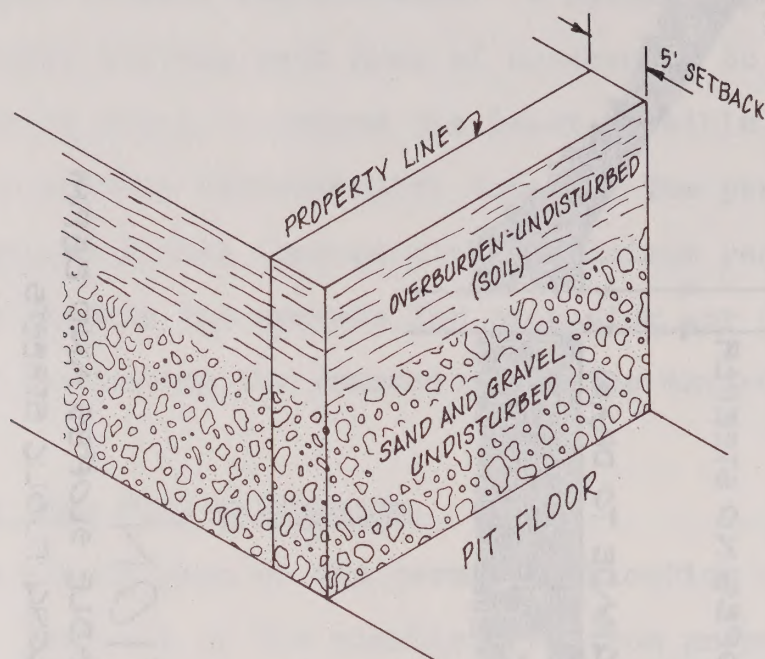
TYPICAL SECTION

SHOWING RECOMMENDED MINIMUM STABLE SLOPES AND BERM WITH LANDSCAPE TO BE PROVIDED ALONG PUBLIC STREETS.

FIGURE 12

Aggregate Resource Study

SETBACK FOR
MINING PURPOSES



MINIMUM SETBACK FOR
RECLAMATION PURPOSES

FIGURE 13

the time overburden stripping commences.

Special Mining Setbacks

To determine the need, if any, for special mining setbacks for health reasons, the use permit application should show the location of all individual sewage disposal systems within 300 feet of the proposed mining area. Water quality control regulations of the County Health Agency and of the Regional Water Quality Control Board will assist in determining special mining setbacks which may be necessary from the identified sewage disposal seepage pits and leachline fields. All setbacks delineated by the mining plan would be subject to the approval of the Sacramento County Health Agency and the Regional Water Quality Control Board.

Slopes

All reclaimed slopes should support erosion control seeding, and be stable and safe. Reclaimed final slopes should in no case be steeper than minimum grade of $1\frac{1}{2}$ horizontal to 1 vertical. Slopes closer to horizontal than $1\frac{1}{2}$ to 1 may be acceptable.

Operating Time

Operation of mining, processing and related activities should not occur on Sunday, and labor union holidays, or

earlier than 6:00 a.m. nor later than 10:00 p.m. Monday through Friday, or earlier than 6:00 a.m. nor later than 3:00 p.m. on Saturday. Applications should state the hours of operation the permit is to be conditioned for. Sound reasons should be presented as to why the County should allow longer operating hours from those suggested above.

Fencing and Posting

Surface mining and mineral processing are not unlike many industrial enterprises, possessing hazards and dangers to unknowledgeable and/or trespass individuals. To some, a mining site could constitute an attractive nuisance. Therefore, barriers and warning signs to prevent trespass are a necessary precaution.

Fencing not less than six (6) feet in height above the grade of property outside the fenced area should be provided around the processing equipment, storage areas, and around land disturbed by surface mining. The bottom of said fencing should conform to the ground surface so as to prevent any opening between the fence and the ground surface from exceeding four (4) inches. Gates of the same height as the fence should be installed at all vehicular and pedestrian ingress and egress points.

Signs warning against trespass should be posted for at least every 500 feet of fencing. Faded, defaced and other-

wise illegible signs should be regularly replaced or repaired.

Traffic

Permit applications should make specific provisions for off-street parking facilities for customers, employees and equipment storage. The application should show the anticipated street truck routes to freeways and major arterials and operation site ingress/egress points.

Dust

Descriptions of anticipated air pollution control equipment and methods for dust control should be included in the permit application. Applicants should consider the use of conveyer belts or other methods of equal satisfaction that will minimize dust created by the movement of aggregates from the mining pit to the plant.

The application should make specific provisions for all roads and unpaved working areas within the site being used by trucks and equipment to prevent the generation of dust.

The application should also consider a dust removal program for public roads in the near vicinity (e.g., 1500 ft.) of truck accesses to the site.

Noise

Applications should incorporate the following minimum

noise restriction. The sound level created by the proposed use at the boundary of the permitted area not fronting a public road should not exceed 70 dBA, except along a boundary contiguous to another area which is permitted for aggregate operations. The sound level created by the proposed use at boundaries fronting on public roads should not exceed the ambient noise level. The operation would be in violation of these noise restriction conditions when the noise level at the property line exceeds a) the noise limit for a cumulative period of more than thirty minutes in any hour, or b) the noise limit plus 5 dB(A) for a cumulative period of more than twelve minutes in any hour, or c) the noise limit plus 10 dB(A) for a cumulative period of three minutes in any hour, or the noise limit plus 15 dB(A) for a cumulative period of more than one minute in any hour, or the noise limit plus 20 dB(A) for any period of time.

Aesthetics

The application should provide for buffering to insulate the proposed use from existing and potential non-compatible uses which may adjoin the site. Buffering may be by earth berming, screen fencing, landscaping, setbacks or a combination of these.

The application should provide for a combination of berming and landscaping at least eight (8) feet in height

above the elevation on any street frontage where mined lands occur.

Wastes

The nature and amount of wastes that are anticipated to occur on the site, and methods of waste disposal (e.g., land fill) should be stipulated in the application.

Seeding

To attenuate the unaesthetic appearance of lands affected by mining as well as the occurrence of water erosion and dust, revegetation of bare land should be considered as a general condition as well as a specific measure included in a reclamation plan.

Water Quality

The major potential for surface and ground water contamination from aggregate mining is associated with the wastes generated by the aggregate washing operations. The wastes are discharged to settling ponds, percolation ponds, or directly to water courses.

Many of the prime aggregate mining areas correspond with former stream or river channels, and a relatively direct contact with the aquifer would be likely, allowing a potential for chemical and total dissolved solids percolation into the

ground water. Therefore, measures should be taken to prevent the percolation of adverse chemicals and minerals into the underlying ground water.

The potential for water contamination includes the proximity of the 100 year frequency flood plain to ponds, run-off from truck and form washing operations, and the discharge of this water drainage into local water courses.

As an example, there is a remote possibility that ammonium ions (NH_4^+) may be tied up in the clay deposits surrounding the gravels. The exposure of these ammonium ions to conditions favoring nitrification could cause the formation of nitrate ions. Under certain circumstances, this could allow a build up of nitrate ions in the ground water basin with its adverse affects.

In light of the above information, and the need to protect ground and surface waters, surface mining proponents should be required to meet all local and regional water quality standards and regulations. Should the proposed use need a surface water discharge permit from the regional water quality control board, the County should require the applicant to obtain the discharge permit(s) prior to initiating any surface mining.

Run-Off and Flood Control

The aggregate resource area forms an important part of

the surface run-off basin for both Morrison Creek and Elder Creek. These two creeks and their drainage basins are an integral part of the Morrison Creek Stream Group flood control improvements designed by the U.S. Army Corps of Engineers. Aggregate mining and reclamation can dramatically alter the storm water run-off characteristics of local and downstream areas, either favorably or unfavorably; consequently, surface mining proposals should be required to conform and complement the design and purpose of drainage basin flood control systems (e.g., the Morrison Creek Stream Group project) and local drainage improvements.

Written approval of the surface mining proposal's drainage design should be obtained from the Sacramento County Public Works Division of Water Resources. Such an approval should be a prerequisite for the issuance or amendment of a surface mining use permit.

RECOMMENDED COUNTY REGULATIONS

The County of Sacramento should maintain orderly and comprehensive records of all mining activities and mining use permits.

Performance bonds should be required of all surface mining operations to ensure the proper and timely reclamation of areas affected if the permitted party(s) fails financially or operationally to meet minimum conditions. These performance bonds should be coordinated with the reclamation plan. When possible and reasonable, large bonding amounts and time periods should be avoided. Any of the following could satisfy the requirement of a performance bond:

(a) Certificates of deposit payable to the County issued by banks doing business in this state and insured by the Federal Deposit Insurance Corporation;

(b) Investment certificates or share accounts assigned to the County and issued by a savings and loan association doing business in this state and insured by the Federal Savings and Loan Insurance Corporation;

(c) Bearer bonds issued by the United States government or by this state; or

(d) Cash deposited with the County.

The terms and conditions surrounding each of the foregoing types of security should be prescribed by the Board of Supervisors.

The Board of Supervisors should make a specific designation of an agency or department which shall monitor surface mining operations and use permit compliance.

Unless the approved reclamation plan indicates another time basis for periodic county inspection, quarterly County inspections of reclamation should be stipulated in the use permit.

Fifteen days prior to the conclusion of a stage of reclamation, the operator should submit to the appropriate regulatory agency of the County, a progress assessment report, which states in detail how permit plans and conditions have been complied with, and why and which uncomplied conditions have occurred.

If the designated progress assessment agency fails to inspect within a specified time (e.g., 60 days) after the required time or after the receipt of a reclamation progress assessment report filed by the permitted operator, that stage of reclamation should be deemed as acceptable to the County and the appropriate performance bonds should be released.

The current procedure for modifying and revoking conditional use permits is established by Sacramento County Code Section 23.18.015. This code section states that the Planning Commission, on its own initiative or by direction of the Board of Supervisors may hold a public hearing for modifying or revoking any variance or conditional use permit

which has been granted. The Planning Commission may revoke or modify a use permit or variance on one or more of the following grounds:

- a. That such approval was obtained by fraud; or
- b. That any person making use of or relying upon the use permit is violating or has violated any conditions of the use permit; or
- c. That the use for which the use permit was granted is being, or has been exercised contrary to the terms or conditions of such approval; or
- d. That the use for which the approval was granted is so exercised as to be detrimental to the public health, safety, or general welfare so as to be a nuisance.

Any decision to amend, suspend or revoke a mining permit should be based upon the findings of such a public hearing. The forfeiture of a performance bond for reclamation should be based on this same hearing procedure.

The County should adopt a specific variance procedure to allow a departure from use permit conditions on the hours of operation. The variance should only be granted on a day-by-day basis after a written finding has been made that the benefit to the public's welfare would far outweigh any community hardship and/or the work requires a continuous pour of concrete. This and every variance so issued should be placed in the records of the appropriate use permit file.

Since most existing surface mining uses in the County either have a use permit which will expire within the next three years or have no valid use permit at all, all existing uses should not be given any special "grandfather treatment." Unpermitted mining uses should be required to conform to the law and all applications for permit renewal should become subject to these recommended and any other provisions adopted by the Board of Supervisors.

Also, the County should not consider any use permit application for surface mining unless all of the proponent's existing operations in the County are found to be in compliance with stipulated conditions and regulations. It is further recommended that the operator should be required to properly dispose of all wastes, scraps, and abandoned equipment within six (6) months after operations cease. Additionally, the operator should be required to abate all hazardous or nuisance conditions on the site such as unstable slopes, ponds, etc. after operations cease at an old site as may be required by pertinent use permits.

In the past, use permits have been granted to property owners and operators who over time have sold out to other individuals or companies causing no small amount of confusion as to who is accountable for the original use permit conditions. To avoid this problem, ARMTAC recommends that surface mining use permits be patterned after certain aspects of "Williamson Act" contracts.

The Williamson Act contract applies to land and its use over a twenty year period. Changes in ownership do not alter the validity of the contract. This long term control is preferable in use permits for aggregate mining since large operations may continue for twenty to thirty years.

It is recommended that:

- A special type of conditional use permit should be utilized for aggregate mining and processing. This surface mining use permit should be recorded with the deeds of all permitted parcels through the County Clerk's Office. A permanent record of the permits is thereby made available to the property owner, the general public and any interested party. The use permit should not be valid until the proponent has demonstrated proof of the recordation of the use permit, as it was approved.
- The permit applies to the land being regulated with the permit conditions transferring to any new owners and operators of the land over the life of the permit.
- Whenever ownership or mining control is transferred, the County should require notification and reserve the right of amending or cancelling the use permit at that time.

Some citizens concerned about the adverse aspects of aggregate mining are not always satisfied with the government regulation process because of the inconsistent response between the reporting of a complaint and the verification of a violation by an inspector. Since violations of noise, dust or vibration often do not occur on a continuous basis, inspectors often do not catch violators in-the-act, which is the only time enforcement can come into play.

To provide the people a better measure of protection, it is recommended that Sacramento County establish a highly responsive monitoring program to check for compliance with operation and reclamation standards, regulations and conditions.

COMMENT

This chapter has brought forth a number of recommendations directed towards more thorough and effective regulation of surface mining land uses. Most, if not all of these recommendations could be implemented almost immediately as an interim measure until decisions are made as to whether or not the present land use policies, plans, and zoning tools need amending to better preserve aggregate resources and to foster the logical continuation of aggregate surface mining.

Millions of tons of high quality sand and gravel resource exist within the identified Aggregate Resource Area. According to ARWAC projections, supplying the needs of the County through the year 2000 will require the use of 1.5 net square miles of aggregate bearing lands.

ARWAC believes that in view of the magnitude of the County's need for aggregate, the dynamics of the Supply-Demand-Choice discussed in Chapter III, the uncertainty that extensive aggregate resources exist that provide exist elsewhere in the County, and the compatibility

CHAPTER VI

LAND USE RESOURCE MANAGEMENT

There is a positive need for land use management to sustain aggregate resources.

Four basic land use management alternatives have been identified, each providing a different measure of resource management for the resource area. Each alternative has been evaluated in its effectiveness in providing aggregate resources to provide for expected needs of the County through the year 2000.

ARWAC RECOMMENDATION

After careful examination of the four alternatives and the need to maintain the aggregate resource area, the Aggregate Resource Management Advisory Committee unanimously selected alternative number 2.

Millions of tons of high quality sand and gravel resource exist within the identified Aggregate Resource Area. According to ARMTAC projections, supplying the needs of the County through the year 2000 will require from 5.5 to 6.9 net square miles of aggregate bearing lands.

ARMTAC believes that in view of the magnitude of the County's need for aggregates, the dynamics of Location-Supply-Demand-Choice discussed in Chapter III, the uncertainty that extensive high quality aggregate resource deposits exist elsewhere in the County, and the incompatibility between residential and surface mining land uses, there is a positive need for land use management to husband aggregate resources.

Four basic land use management alternatives have been identified, each providing a different measure of resource management for the resource area. Each alternative has been evaluated in its effectiveness in husbanding aggregate resources to provide for expected needs of the County through the year 2000.

ARMTAC RECOMMENDATION

After careful examination of the four alternatives that follow, the Aggregate Resource Management Technical Advisory Committee unanimously selected alternative number 3

as the most desirable land use and resource management alternative. The committee recommends that the County adopt alternative number 3, as proposed, for the following reasons: Alternative number 3...

1. Establishes clear land use policies for surface mining, resource conservation, and environmental protection;
2. Creates the land use management tools necessary to establish a distinct relationship between resources, land uses, and zoning regulations;
3. Establishes a new General Plan land use category, a new combining zoning district for surface mining, and a use permit process which would effectively manage sand and gravel operations and resources while providing the means for protecting the community and the physical environment from nuisance and harm.
4. Provides a uniform methodology to process use permit applications.
5. Discourages the development of single family houses on lots less than ten acres in size within the aggregate resource area.
6. Identifies aggregate resource areas in the General Plan map and in the Environmental Conservation and Resource Management Element map. This same technique could be used to identify other mineral resources.
7. Identifies in the zoning maps where surface mining may occur.

ALTERNATIVE I:

NO CHANGE IN PRESENT PLANNING AND ZONING CONTROLS

This alternative consists of the present land use measures and controls as provided by the 1973 General Plan and the County Zoning Code. Within the aggregate resource area, three General Plan Land Use Categories (L.U.C.) occur:

<u>Land Use Categories</u>	<u>Acres</u>	<u>%</u>
Industrial Intensive	5340	74%
Industrial Extensive	940	13%
<u>Agricultural-Urban Reserve</u>	<u>940</u>	<u>13%</u>

For the largest area, the Industrial Intensive L.U.C. the County General Plan states that this "designation indicates land for research, manufacturing, processing and warehousing activities of an intensive nature. These uses will normally require adequate streets, utilities and fully improved sites." The Industrial Intensive areas are either anticipated to be served by public improvements, or are already provided with such services. The General Plan policy thus encourages industrial development to occur within the Industrial Intensive L.U.C.

The General Plan zoning consistency has been recently revised to exclude the previously consistent small lot agricultural zones (A-1B, A-2, and A-5) from the Industrial Intensive L.U.C. Of the four zones which allow aggregate mining subject to the issuance of a use permit (A-1B, A-2,

Flood, M-2) only the M-2 zone now occurs in this L.U.C.

The second L.U.C. is the Industrial Extensive with some 940 acres. The General Plan states that the Industrial Extensive is a reserve area for industrial development after 1990, unless an industrial proponent intends to provide its water and sewage systems. Among the many zones which are consistent with the Industrial Extensive, only the M-2 Heavy Industrial Zone allows mining subject to the issuance of a use permit. The smallest agricultural zone under the Industrial Extensive is the A-10 agricultural zone, which allows the development of a single family house on a ten acre minimum area lot.

The remaining 940 acres of aggregate resource area is under the Agricultural-Urban Reserve L.U.C. This category is designated by the General Plan as a reserve area for future urban growth. In the interim, agricultural uses are encouraged by the General Plan. As with the other two Land Use Categories, A-10 is the smallest agricultural zone consistent. None of the four zones which provide for aggregate mining are consistent with this L.U.C.

The County's zoning code provides for the mining of aggregates through four zoning districts: The A-1B general agricultural zone, the A-2 general agricultural zone, the M-2 Heavy Industrial zone, and the Flood zone. These zones allow the mining of aggregates subject to the issuance of a use permit.

Aggregate Resource Study

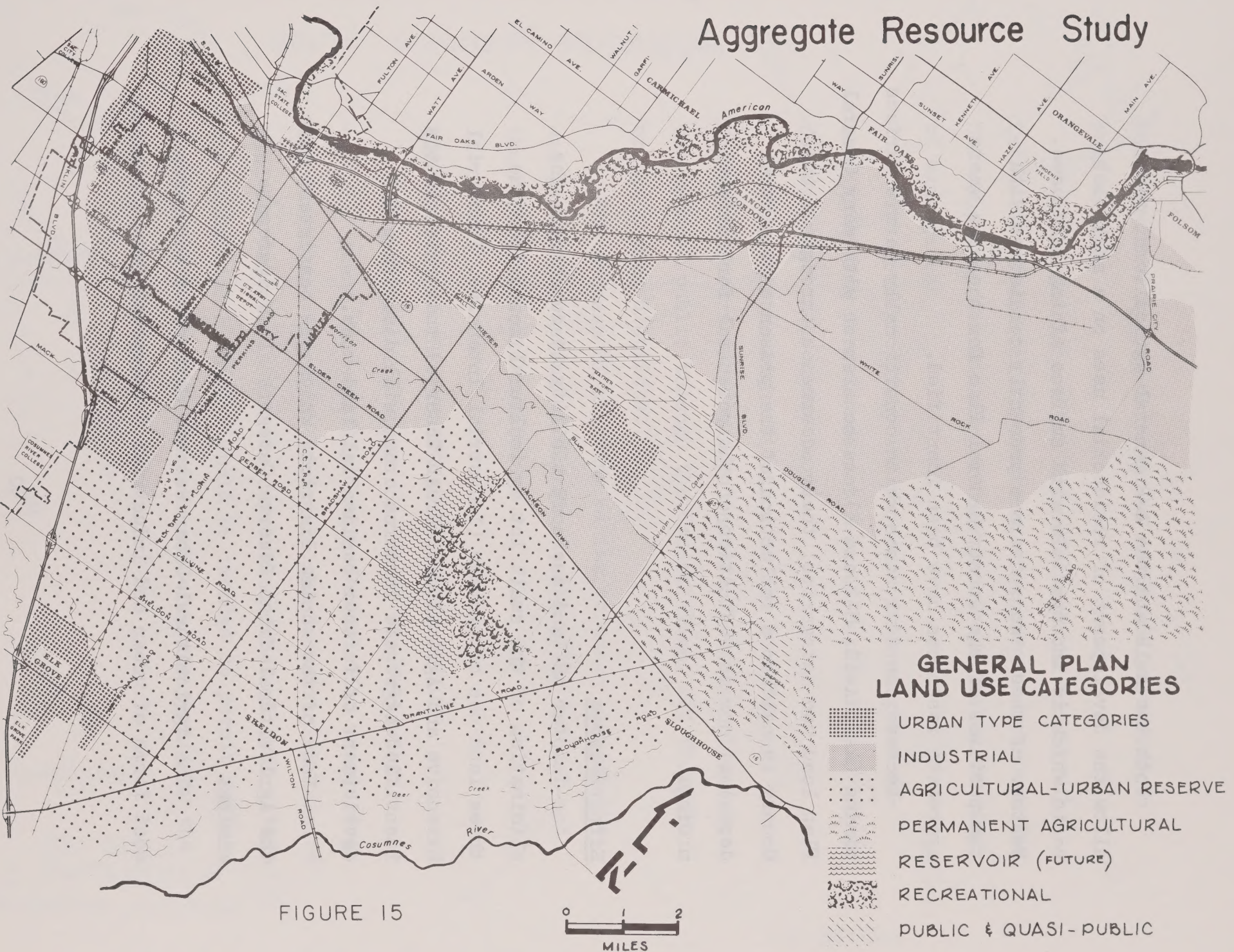


FIGURE 15

Both the A-1B and the A-2 general agricultural zones allow the development of residential uses on a small lot basis which is incompatible with surface mining land uses. Neither of these two zones are presently consistent with the policies of the County General Plan for the area where aggregate resources have been identified.

Because the four zones which conditionally permit surface mining (A-2, A-1B, M-2 and F) are consistent with many General Plan land use categories, their occurrence throughout the County is neither a reflection of the presence of mineral deposits, nor an indication of the potential for surface mining.

Effectiveness

-Insofar as land use compatibility is concerned, the elimination of the small lot agricultural zones from the three land use categories (Industrial Intensive, Industrial Extensive and Agricultural-Urban Reserve) that exist in the identified aggregate resource area, will discourage the development of further residential land uses.

-None of the zoning districts which are consistent with the Agricultural-Urban Reserve Category allow aggregate mining.

-The Agricultural-Urban Reserve Category discourages most forms of urban and industrial development from occurring;

consequently, aggregate resource areas are protected to some extent.

-While the Industrial Intensive and the Industrial Extensive categories allow mining of aggregates through the M-2 zone they neither suggest nor encourage the harvesting of aggregates.

-The present policy and process of issuing and enforcing mining permits has not been effective in providing for reclamation of mined lands.

-There is no identification of the location of aggregate resources or the potential of surface mining to the general public through the General Plan, its elements or the zoning districts.

-The process of allowing mining to occur through the use permit provisions of the Flood, the A-1B, the A-2 and the M-2 zones would remain.

ALTERNATIVE 2: THE INDUSTRIAL EXTENSIVE OPTION

This alternative would consist of the following:

1. Amend the existing County General Plan by placing the identified aggregate area into the Industrial Extensive Land Use Category. All the consistent zones allowed within the Industrial Extensive would be amended to permit aggregate mining subject to the issuance of a use permit by the Board of Supervisors.

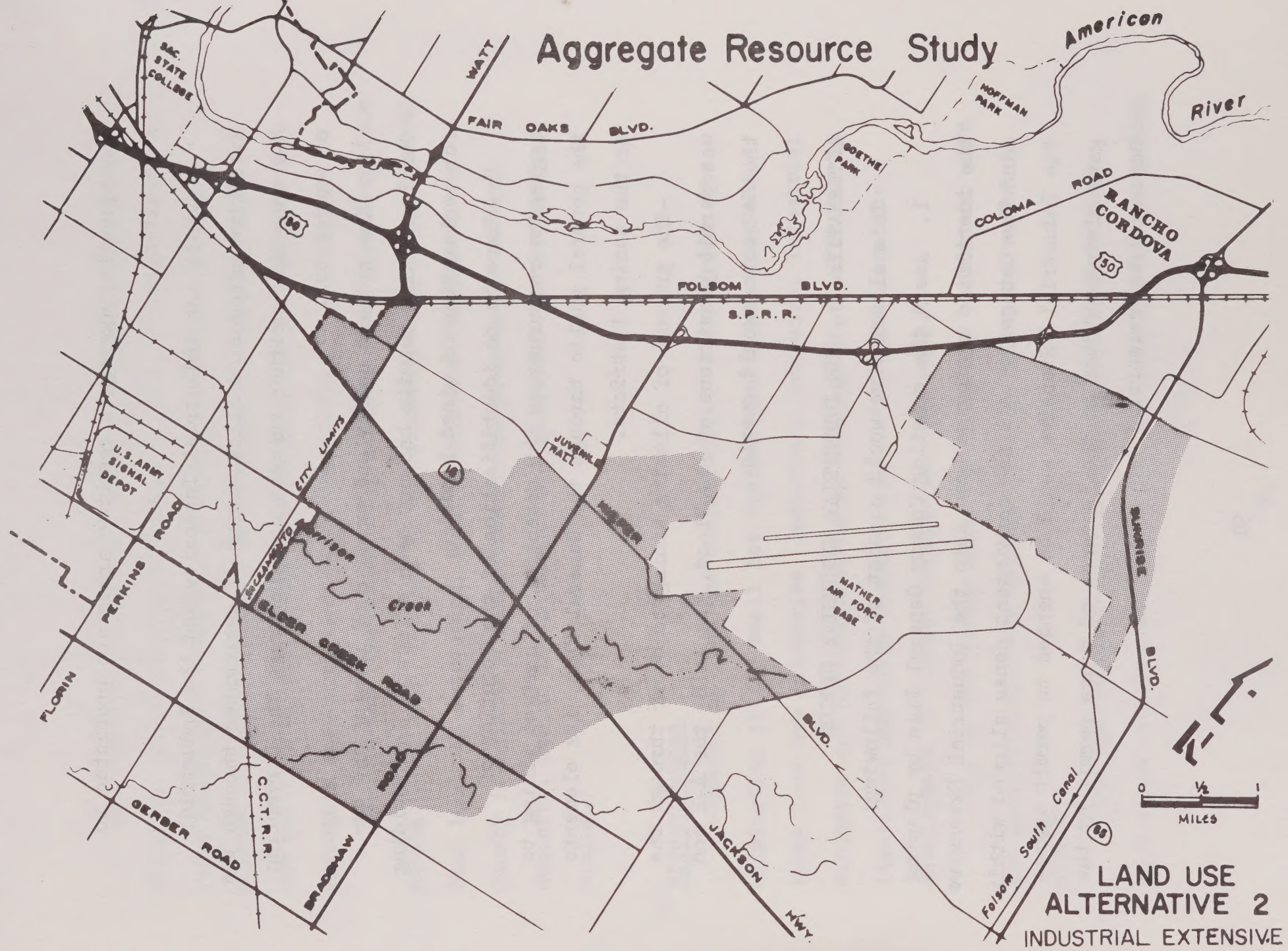


FIGURE 16

2. Surface mining uses would be discontinued as conditionally permitted uses in the A-1B and A-2 zoning districts.

3. In addition, the Environmental Conservation and Resource Management Element would be amended to include a new map identifying the aggregate resource area. The use permit procedure would incorporate additional requirements for a phased reclamation plan, specific performance standards, and a contract for performance and regulation between the County of Sacramento and the mining company.

Effectiveness

- These measures would enhance the preservation of aggregate resources and reduce the potential for incompatible residential uses from occurring within the Industrial Extensive Land Use Category.
- Industrial uses would still be allowed to occur in the Industrial Extensive Land Use Category if they provided their own utilities. Some loss of aggregate resources would inevitably be lost by preclusion due to industrialization.
- Surface mining would not be restricted to the Industrial Extensive aggregate resources area since the zones which would permit mining are also consistent with many other General Plan land use categories. Therefore, mining could occur also in

the Permanent Agricultural, Agricultural-Urban Reserve, Agricultural-Recreation Reserve, Industrial Intensive, Residential Estate and Low Density Residential if a use permit is granted. -Identified aggregate resource areas would be shown not on the general plan map but rather on the Environmental Conservation and Resource Management map.

ALTERNATIVE 3: NEW COMBINING LAND USE CATEGORY

This alternative would consist of the following:

1. Establishment of a new General Plan land use category. The new category would be designated as the Surface Mining Combining Land Use Category (SMCLUC). This new land use category would be overlayed or "combined" with other existing land use categories already shown on the General Plan.

The SMCLUC would identify areas on the General Plan map where mineral resources are known to exist, and to which surface mining policies are directed. While the SMCLUC should not preclude the policies of the basic land use category to which it is applied, the proposed category should be deliberate in preventing land use incompatibility through its selective combination with existing land use categories.

Aggregate Resource Study

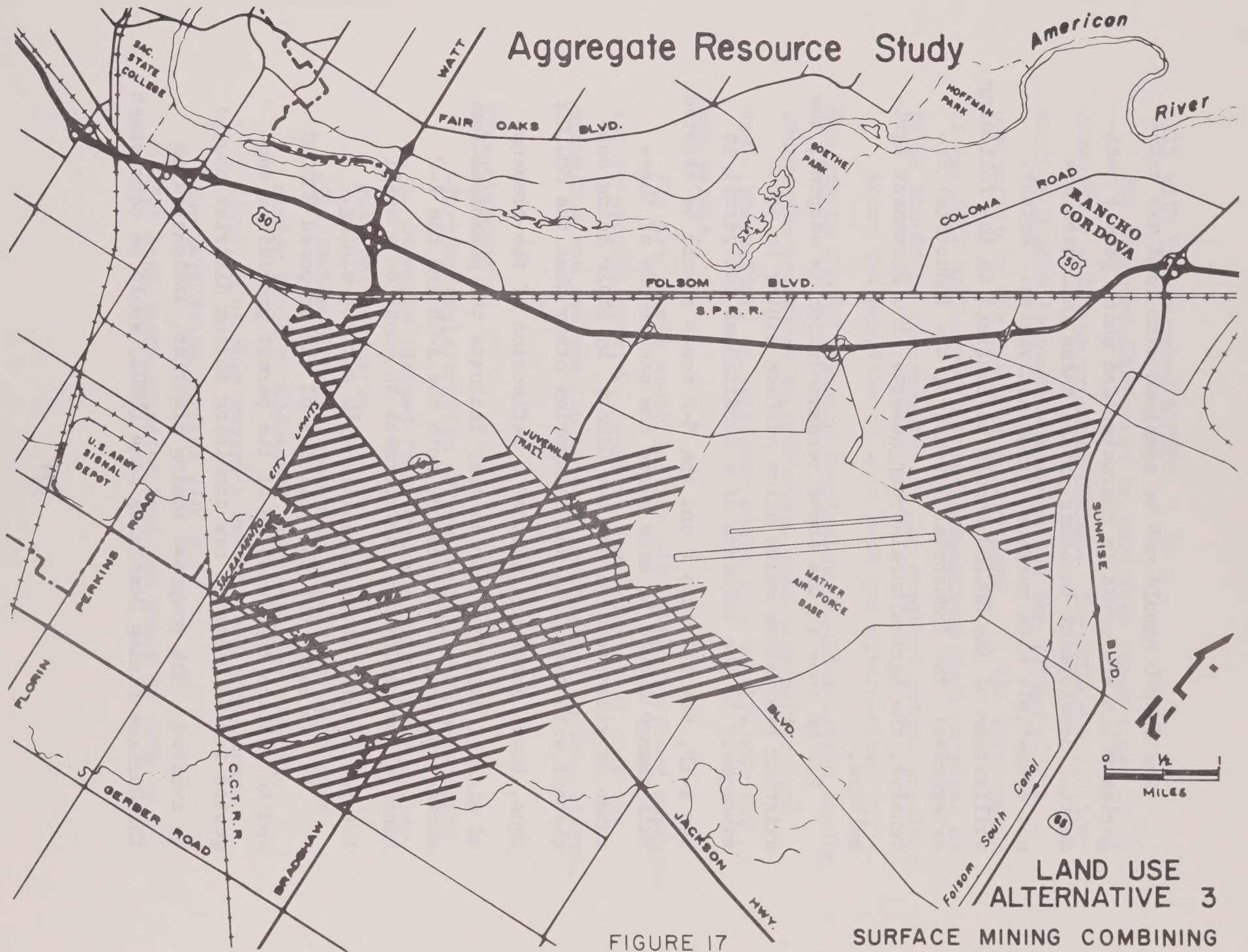


FIGURE 17

SURFACE MINING COMBINING

The SMCLUC should not be combined with land use categories which are urban in character and which permit residential development to occur, since these land uses are not compatible with surface mining activities. Rather, utilization of the SMCLUC should be confined to the following categories: the Industrial Intensive, the Industrial Extensive, the Agricultural-Urban Reserve, the Permanent Agriculture.

2. As soon as the above recommendation is adopted, the existing provisions which allow surface mining to occur subsequent to the issuance of a conditional use permit in the A-1B, the A-2, the F and the M-2 zones should be deleted. This change should be made since the occurrence of these zones is widespread across the County by their being consistent with many land use categories other than the SMCLUC; thus, these zones are neither a reflection of the presence of mineral deposits, nor do they indicate the potential for surface mining. Furthermore, both the A-1B and the A-2 zones allow residential development to occur on a small lot basis which is incompatible with surface mining.

3. To carry out the policies of the proposed SMCLUC and to replace the function of the permit provisions suggested for deletion, a new combining zoning district should be created. The proposed zoning district, designated as the Surface Mining Combining Zone (SMCZ) would be consistent

only with the proposed SMCLUC.

The proposed SMCZ would be used with those zones found consistent with the proposed SMCLUC. The SMCZ would allow surface mining to occur subsequent to the issuance of a use permit by the Board of Supervisors. In the development of the SMCZ ordinance, the recommendations made on pages 80 to 84 should be incorporated to the greatest extent possible.

After the adoption of this land use alternative, the Sacramento County Planning Commission should initiate zoning amendments necessary to effectuate this alternative land use. Thereafter, an applicant would have to file for the use permit.

The use permit would include all of the proposed measures and procedures, review, approval and enforcement covering operation and reclamation aspects recommended in this report.

Effectiveness

- Further proliferation of residential land uses would be strongly limited from occurring within the aggregate resource area.
- The reclamation and operation aspects of aggregate mining would be addressed comprehensively by the adoption of this report's recommended procedures for permitting surface mining.
- The long range expected land use would be clearly

shown in the General Plan Map by the proposed Surface Mining Combining Land Use Category. At the same time, short range land uses could occur which would not be detrimental to surface mining activities.

-Current surface mining land uses would be clearly shown by zoning maps through the proposed Surface Mining Combining Zone.

-Under this alternative three, a large number of zones when combined with the Surface Mining Combining Zone would allow the mining of aggregates, rather than confining the mining to the A-1B, the A-2, the M-2 and F zones.

ALTERNATIVE 4:

SURFACE MINING ALLOWED AND OTHER USES RESTRICTED

This alternative consists of the following:

1. Amend the General Plan to place that portion of the County identified as an aggregate resource area into the Industrial Extensive Land Use Category.
2. The provisions which allow surface mining to occur subsequent to the issuance of a conditional use permit in the A-1B, the A-2, the Flood and the M-2 zones should be deleted. This change should be made since the occurrence of these zones is widespread across the County

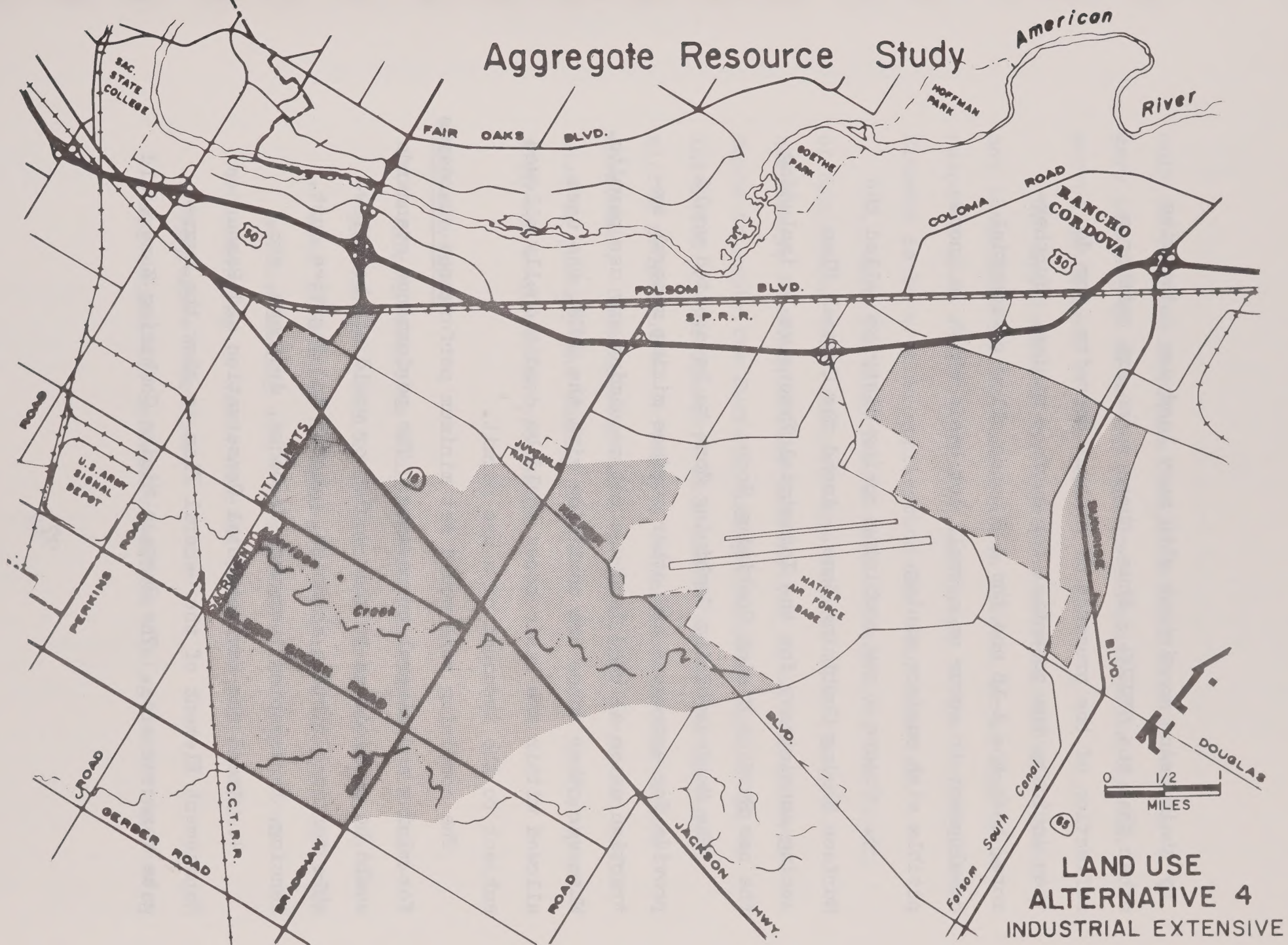


FIGURE 18

by their being consistent with many land use categories other than the SMCLUC ; thus, these zones are neither a reflection of the presence of mineral deposits, nor do they indicate the potential for surface mining. Furthermore, both the A-1B and the A-2 zones allow residential development to occur on a small lot basis which is incompatible with surface mining.

3. Create a new combining zoning district called the Surface Mining Combining Zone. Amend the General Plan zoning consistency for the Industrial Extensive by including the new Surface Mining Combining Zone.

The Surface Mining Combining Zone to be created would provide for aggregate and other surface mining mineral extraction as an allowed land use not requiring any use permits. Whenever other zones are combining with the SMCZ, the uses allowed within the basic zones would be conditionally allowed subject to the issuance of a use permit.

The combining zone would set minimum performance standards for mining and mineral processing. The performance standards would be explicit as to what would, or would not be allowable for such factors as noise, process and fugitive dust, fencing, landscaping, berming, setbacks, drainage, etc.

4. Amend the Environmental Conservation and Resources Management Element of the General Plan to show the aggregate resource area. The Surface Mining Combining Zone would

only be consistent within the Industrial Extensive category identified as having aggregate resources in the Conservation Element of the General Plan.

5. Applications for aggregate surface mining in areas not identified in the Conservation Element as an aggregate resource area would require an amendment of the Conservation Element to be a valid application for consideration.

6. Upon the adoption of this alternative, the County of Sacramento would initiate the General Plan changes necessary; however, unlike alternative 3, no zoning amendments to apply the Surface Mining Combining Zone would be initiated by the County. It would be up to the aggregate mining proponent to initiate a request for such a zoning amendment. Under alternative 4, the mining proponent would have to justify the zoning change on the basis of his operation and reclamation proposals.

Effectiveness

-This alternative could strongly discourage all incompatible and preclusive land uses from occurring in the area identified as aggregate resources area. Similarly, surface mining could be somewhat discouraged from occurring in areas outside those identified with aggregate resources.

-To obtain the necessary surface mining combining zone,

the applicant would be required to file an application for a zoning map amendment with the Sacramento County Planning Commission. When the zoning request is granted, there would be no procedural or policy impediments to aggregate mining as long as minimum performance standards were being met as stipulated by the proposed SMCZ.

-Unless specified adequate performance standards are contained in the proposed SMCZ for the operation and reclamation of surface mining areas, the community would not be protected from the potential nuisances and hazards of surface mining. The development of meaningful performance standards would be an extremely difficult task.

COMPARISON CHART

ALTERNATIVES FOR THE MANAGEMENT OF AGGREGATE RESOURCES

	1		2		3		4	
General Land Use Category	Industrial Industrial Ag.- Urban	Extensive Intensive Reserve	Industrial Extensive	Extensive	Proposed Surface Mining Combining Land Use with In- dustrial Extensive, Industrial Inten- sive, Agriculture & Ag.-Urban Reserve		Industrial Extensive	
Zoning Districts consistent with the above	AG-80 AG-20 A-80 A-20 A-10 O	C-O G-C T-C M-1 M-2 (F)-Com- bining	AG-80 AG-20 A-80 A-20 A-10 M-1 M-2 (F) Combining		AG-80 AG-20 A-80 A-20 A-10 O G-C M-1	M-2 (F) Com- bining Proposed surface mining combining zone (SM)	AG-80 AG-20 A-80 A-20 A-10 M-1 M-2	(F) Com- bining proposed surface mining combin- ing zone (SM)
Zones which will/or do allow Aggregate Mining subject to use permit	M-2 F		M-2 F		All zones indicated above when combined with (SM)		None Note*	
Zones which would allow Aggregate Mining without requiring a use permit	None		None		None		Proposed sur- face mining com- bining zone(SM) (The applicant will be required to file for the zoning change.	
Identification of Aggregate Resource Area in General Plan:	No		No		Yes		No	
in Conservation Element:	No		Yes		Yes		Yes	
in Zoning Maps:	No		No		Yes		Yes	

Note* All other uses allowed within the above zones other than aggregate mining will be required to secure a use permit.

LABORATORY METHODS OF DETERMINING SUITABILITY
OF SAND AND GRAVEL FOR USE AS AGGREGATE IN PORTLAND
CEMENT CONCRETE

<u>Property of Aggregate</u>	<u>Importance in Concrete</u>	<u>Test Methods</u>	<u>Reference to Tests*</u>
Abrasion Resistance (Hardness and durability)	Affects strength, resistance to wear	"Los Angeles Rattler"; measure proportion of fine material produced by abrasion in revolving metal drum after 100 and 500 turns.	ASTM test C131-51 (ASTM 1954, p.40)
Soundness (lack of fissures in particles)	Affects strength, susceptibility to frost damage from expansion of absorbed water.	Alternately soak in sodium or magnesium sulfate solution and dry; crystallization of absorbed solution forces open invisible cracks. Subject tests beams made with aggregate to alternate cycles of freezing and thawing.	ASTM test C88-46T (ASTM 1954, p.76) ASTM test C290-52T (ASTM 1954, p. 191)
Specific gravity - dry and with absorbed liquid	Determines mass (specific gravity commonly specified 2.5 or more); absorption affects bond of cement paste to particles.	Compare oven-dry weight with immersed weight, and weight after surface redried.	ASTM tests C127-42, and C128-42 (ASTM 1954, pp.82,84.)
Size grading characteristics	Affects flowability, residual void spaces, strength	Standard Sieve analysis; screen in standard-size screens; weigh various fractions; plot on appropriate graphs.	ASTM test C136-46 (ASTM 1954, p. 69)
General Characteristics: 1. Particle shape 2. Character of surface 3. Grain size 4. Texture (e.g., pore-space, grain packing, cementation) 5. Color 6. Mineral composition 7. General physical condition (e.g., weathering) 8. Presence of potentially deleterious chemical substance (e.g., gypsum, zeolite, pyrite, opal, chalcedony, volcanic glass)	Different effects on strength, hardness, color, and permanence of concrete	Examine by naked eye, hand lens, and under petrographic microscope	ASTM test C295-54 (ASTM 1954, p. 97)
Potential chemical reactivity	Affects permanence of concrete; reactive substances cause "popouts" and failures due to expansion	Weigh silica dissolved in sodium hydroxide solution; measure reduction in alkalinity caused by immersion of sample in standard sodium hydroxide solution. Measure expansion of mortar bars made with aggregate over lengthy periods; 1-2 years	ASTM test C289-54T (ASTM 1954, p. 57) ASTM test C227-52T (ASTM 1954, p. 296)
Lack of organic matter (coal, lignite, organic impurities)	Affects strength, resistance to wear	Separate material lighter than 2.0 specific gravity in heavy liquid, and weigh; compare color of sample with standard color solution-dark color assumed due to organic material	ASTM tests C123-53T and C40-48 (ASTM 1954, pp.51,56).
Cleanliness (lack of dirt, clay, or silt finer than 200 mesh)	Determines quality of bond with cement.	Measure material passing 200-mesh sieve; measure suspended material after shaking in water.	ASTM test C117-49 (ASTM 1954, p. 47)
Unit weight	Determines mass	Weigh aggregate contained in standard cubic foot measure	ASTM test C29-42 (ASTM 1954, p. 90)
Lack of soft or friable fragments	Affects strength, resistance to wear	Scratch test using brass rod of Rockwell hardness B65 to B75; rock softer than rod is unsatisfactory	ASTM test C235-54T (ASTM 1954, p. 74)
Toughness	Affects strength, resistance to wear	Impact; measure distance a standard-size hammer drops on specimen to fracture it	ASTM test D3-18 (ASTM 1954, p. 88)

* Standardized tests as outlined by the American Society for Testing Materials: ASTM Standards on Mineral Aggregates, concrete and Nonbituminous Highway Materials, December 1954.

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